Publication No. FHWA-PD-92-037

Case Study No. 16

A Study of Bicycle and Pedestrian Programs in European Countries

U.S. Department of Transportation
Federal Highway Administration

National Bicycling And Walking Study

Foreword

This case study was prepared under contract for the Federal Highway Administration by George G. Wynne, ASLG.

Notice

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trademarks or manufacturers' names may appear herein only because they are considered essential to the object of this document.

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official policy of the Department of Transportation.

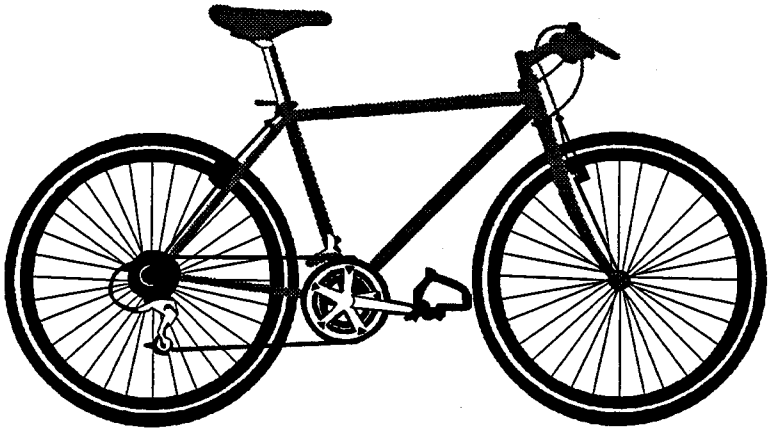
This report does not constitute a standard, specification, or regulation.

A Study

of

Bicycle and Pedestrian Programs

in European Countries



January 1992

Table of Contents

EXECUTIVE SUMMARY

Most European nations have embarked on programs to reduce congestion, lower traffic accidents and improve the safety of cyclists and pedestrians. This paper concentrates on the ways bicycle and pedestrian facilities have been improved and cyclists and pedestrians benefited by these practices of "traffic calming."

The use of bikes for home-to-work trips is promoted by comprehensive programs of bike path construction, improved linkages with public transportation, such as secured "Park and Lock" bike storage facilities at commuter stations and in central business districts. In some cases, commuter trains and street cars provide space to store bikes out of the way of other passengers.

Only one country, the Netherlands, has gone so far as to establish an official national bicycle policy, but guidelines and design standards for bike and pedestrian paths as a component of national or regional traffic calming and speed reduction programs are a widespread practice.

The countries selected for this review include Austria, Denmark, Finland, the Netherlands, Norway, Germany, France, Sweden, the U.K. and Switzerland. They all have programs to encourage cycling and walking and, in some of their major cities, the participation of bicycles in urban traffic represents a third or more of all trips made.

(Efforts to obtain comparable institutional data from Eastern European countries have not been successful, but we have come across anecdotal evidence indicating that cycling facilities are deficient and that the activity is not emphasized to the same degree as in western Europe either for commuting or recreational use.)

Widespread car restraints put into practice, after years of testing in demonstration programs, have been remarkably successful in lowering speeds and reducing traffic accidents. Average car speeds, as well as traffic casualties among cyclists and pedestrians, have been reduced by one third or more in a number of cities and regions. At the same time, cycle path construction programs, coupled with design and signaling innovations, have improved traffic amenity and safety for cyclists, leading to a greater use of bikes for home-to-work commuting and shopping trips.

Greater pedestrian safety and comfort have also resulted from the widespread institution of protected residential neighborhoods that are characterized by Europe-wide traffic signs and design practices. The associated network of pedestrian zones in central business districts has boosted retail trade and made downtowns more lively and livable.

Starting in Delft (Netherlands) in the mid-1970s, the "woonerf" concept of a protected residential environment with street space shared equally among

pedestrians, cyclists and cars "proceeding at walking pace," came into widespread use, first throughout the Netherlands, then in adjoining countries, especially western Germany.

Throughout Germany there are currently thousands of speed-restricted zones, characterized by physical restraints to slow automotive traffic and provide a more secure street environment for cyclists and pedestrians. In a before-and-after study, speed reductions were confirmed in a majority of cases. The evaluation showed that speed reductions were obtained more effectively from "hard" design elements such as changes in the road surface, traffic islands and roundabouts than from traffic signs and visual effects.

Research results in a number of European countries indicate that segregated bike paths are no panacea as concerns safety, though they can be of help, especially for inexperienced cyclists. Shared roads can be just as safe when space for cyclists is reserved by clear markings and signal lights are properly phased. In mixed traffic, the researchers found, road users tend not only to act more carefully, but also to reduce speed, the prime cause of traffic accidents.

There is a large and imaginative catalogue of European practices that make life easier for both cyclists and pedestrians and that have been tested extensively in practice for more than 20 years. These include counterflow lanes on one-way streets, sometimes permission to ride in segregated bus lanes, and such known design techniques as narrowings, neckdowns, texture changes, gateways, medians, traffic islands, speed bumps, rumble strips and the slight raising of bike paths above pavement level for easier identification. Distinctive road markings, plantings, pavement tiles, warning signs at entry points to protected neighborhoods and pedestrian-scale lighting fixtures to illuminate speed restricted zones also help, and they deserve to get wider attention in the United States.

Other significant findings include that the number of bicycle trips in the western part of Germany has gone up by 50 percent over the past 10 years, and in several localities, including Bonn, cycling has doubled during this period. While this seems the most impressive figure, bike traffic has also increased significantly in the other countries. (A modal split of 80/20 in favor of bikes is reported in the Dutch town of Houten, Groningen has 55 percent, Muenster, Germany, about a third.) The trend towards improved pedestrian amenities that encourage walking in city centers is perceivable in most western European countries. Its outcroppings include better street cleaning, more public art and outdoor sculptures, well-tended seasonal flower beds and sidewalk decorations, along with playful, post-modern street furniture that has replaced the severe functionalism of the early post-war era.

The traffic safety of both cyclists and pedestrians after dark is enhanced in Europe by a wide variety of reflective materials and devices. These include "bicycle safety spacers" as well as reflective discs and garment stripes for pedestrians which increase nighttime visibility by a factor of ten or more. According to Finnish and U.K. studies, the reflective discs make drivers give cyclists a wider berth and have helped lower collisions, especially sideswiping incidents. On the other hand, bike safety helmets are used to a much lesser extent in Europe than in the U.S. The

European Cycling Federation opposes their mandatory use as an infringement of personal freedom without adequate proof of need.

Safe bike riding is promoted in primary schools. In at least one instance, instructional classes are followed by tests and the award of a bike qualification certificate in Munich, Germany.

Improved access for cyclists to public transportation is another area in which U.S. transportation agencies and cities could look to Europe for relevant experience. Commuter station access for bikes, guarded storage and bike lock-up facilities at commuter train and bus terminals in the suburbs as well as downtown and non-rush hour opportunities to take bikes along on public conveyances are among the bike/transit linkages common in Europe. Day trip marketing targeted to cyclists for family holidays, and cycle rental programs operated by national railway systems, are also impressive.

Registration and licensing systems, including indelible markings and the issuance of license tags for bikes by local police agencies, as is the case in Switzerland, can help discourage bike theft, which is a problem also in most of Europe. Several European cities are making reconditioned bikes available to urban users free of charge. These bikes are sometimes painted a distinctive "ugly" color and come with non-standard fittings to aid in identification and to discourage theft.

Public-private cooperation models, such as the French Club des Villes Cyclables, organized by elected officials of bike-friendly cities have demonstrated effective advocacy for specific improvements. The networking by such groups, domestically and across international boundaries, can have a multiplier effect in keeping the concerns of advocates before policy makers and public officials in other countries and continents.

This paper urges the establishment of a clearinghouse, making full use of existing user and advocacy groups in the U.S., to provide the public sector with effective, professional inputs for policy formulation and resource allocation decisions that promote bicycle and pedestrian facilities locally and nationally.

General Considerations

Even though the United States has more than 100 million bikes according to a Worldwatch Paper[1], these are used primarily for recreational purposes and they are off the street most of the time. The same study notes that just one in 40 bikes in the U.S. is used for commuting, the rest are ridden only occasionally for fitness, recreation and sport, or are gathering dust in the basement.

In western and northern Europe, bikes, on other hand, have traditionally been part of the modal mix for commuting and shopping in addition to their recreational use.

However, with rising post-war affluence in post-war Europe as well, the private car and the personal mobility it affords has resulted in widespread car ownership with vehicle to population ratios approaching those of the U.S. Trends comparable to the U.S. towards downtown congestion, overcrowded highways, suburbanization, longer commutes and changing land use patterns, such as the displacement of shopping centers to the suburbs and exurbs, have become evident. (World-wide, the motorization trend has brought a fivefold increase in vehicle registrations over the past 30 years, up from about 125 million in 1960 to an estimated total that approaches 600 million. The world-wide bike fleet estimate is in the range of 800 million, but they are not used as much for home-to-work trips except in developing countries where pedal power is the only alternative to walking that most people can afford.)

The steady increase in private car ownership and use in western and northern Europe with its attendant competition for road space has also led to higher accident figures, marked reductions in the speed of public transit, more traffic noise and pollution—altogether, a widespread decline in the quality of urban life.

In the process, pedestrians, in particular children, the elderly, cyclists, and other vulnerable traffic participants, such as people with handicaps, have found themselves in increasing danger and have, in some cases, almost literally been forced off the road.

However, starting in the mid-1960s and continuing to this day in an accelerating fashion, western and northern European countries have recognized the problems engendered by the success of the private car as a universal transport mode and embarked on policies and programs to reduce traffic congestion, noise and pollution, reduce traffic accidents and improve traffic safety in urban areas. Associated objectives cited by planners include energy conservation and improvement of the deteriorating urban quality of life.

---

[1] Marcia D. Lowe, Worldwatch Paper 90: The Bicycle—Vehicle for a Small Planet, 1990, reference #97.

This paper concentrates on the ways cyclists and pedestrians have been the beneficiaries of these coordinated policies and actions which can be generally subsumed under the heading of "traffic calming." Speed restrictions in residential neighborhoods and (increasingly) wider urban districts, traffic management and road space design, including the sharing of street space among traffic participants, are the tools used to achieve the objective of traffic calming. Speed limits in shared areas are as low as 20 km/h (12.5 mph) and they are enforced not only by traffic signs but by physical restraints that force drivers to pay special attention and drive at walking pace.

Traffic planners and public authorities likewise are using a "carrot and stick" approach to persuade people to abandon their cars in favor of public transport. The promotion of a wide range of associated measures that improve conditions of safety and amenity for cyclists and pedestrians forms an integral part of this strategy. Planners' tools include building "park and ride" lots next to commuter stations, raising the cost and reducing the number of parking opportunities downtown and imposing the drastic speed restrictions within city limits. The widespread creation of pedestrian zones and shopping streets closed to private cars in both major and secondary cities forms part of this approach, along with restrictions on through traffic. Requirements to share street space with bikes and pedestrians in much of the city give drivers additional incentives for the use of public transport.

The use of bikes for home-to-work trips is also promoted by comprehensive programs of bike path construction and improved linkages with public transportation, such as secured "park and lock" bike storage facilities at commuter stations and in central business districts. In some cases, commuter trains and street cars provide space to store bikes out of the way of other passengers.

Bicycle and Pedestrian Policies and Programs

Design and Safety Considerations

Transport ministries and local authorities in Europe, especially in the Scandinavian nations and the Netherlands where flat roads and dense residential patterns made the bike popular from the start, are devoting considerable attention and resources to the construction of safer cycle paths and cycle lanes. National demonstration projects are underway in several countries with the objective of reducing the number of traffic accidents involving cyclists which have remained unacceptably high in recent years while the total number of traffic fatalities and injuries has declined. Only one country, the Netherlands, has gone so far as to establish an official national bicycle policy, finalized last year by the Ministry of Transport and Public Works under the name of "Masterplan Bicycle."[2] However, guidelines and design standards for bike and pedestrian paths as a component of national or regional (state-wide) traffic calming and speed reduction programs are a widespread practice throughout Europe. Several countries are conducting "bike-friendly cities" competitions and demonstration programs. Our report draws on representative national design standards and local bicycle and pedestrian facilities promotion programs.

Commencing with Austria, responsibilities for bike paths and pedestrian zones are exercised by the federal states (Laender), the capital city of Vienna, which has Land status, and local authorities. There are no national policy pronouncements as in the Netherlands, but Vienna and major state capitals, like Salzburg and Graz, pursue an activist policy in the planning and construction and operation bike paths and pedestrian zones.

Vienna's net of bike paths which had declined to a mere 11 km in 1977 has increased to about 270 km in operation or under construction in 1992. However, the bulk of these are used for recreation, with weekend use about two-and-a-half times as high than that of working days. A 1983 survey determined that only one tenth of the cyclists questioned used their bikes for home to work trips.

As concerns pedestrian zones, Vienna has accelerated its construction program in the last 5 years, currently maintains about a million square meters in more than fifty pedestrian precincts, scattered throughout the capital's 22 districts. More than half of these were planned and executed since 1984, the initial 450,000 square meters, including the historic Kaertnerstrasse shopping mile which connects the opera to St. Stephen's cathedral in the first district, were built between 1974 and 1984. Associated traffic management schemes prevent through traffic in historic districts. In the case of Vienna's inner city vehicular traffic that enters the historic

[2] Letter, Netherlands Embassy, p. 52, reference #44.

area is prevented from driving through it. One way street and directional signs insure that it returns to the vicinity of its entry point.[3]

A similar bike- and pedestrian-friendly attitude characterizes the festival city of Salzburg (pop. 140,000) which has closed most of its inner city to through traffic and long ago reserved its principal shopping and strolling street for pedestrian use, except for emergency vehicles and taxis that are permitted to drop off tourists at hotels.[4] Both Vienna and Salzburg use imaginative ploys to encourage a "park and walk" attitude among their residents, such as the temporary use of public buses, dubbed "package buses" parked in main pedestrianized squares as parcel checking facilities during the Christmas shopping weekends.

Salzburg aims at a 20 percent traffic participation by bikes in this decade, and has spent the equivalent of $7 million to expand its 120 kilometer network of bike paths over the past 10 years. The city has also canceled the construction of a 3,000 space car park that was to have been built under the Salzach river which traverses the city and gave it its name. Instead, the city government has devoted funds to the completion of a missing bike path link along the river in the historic city center. Since its was finished 3 years ago, the daily bike count along the riverside path has risen from 900 to 5,200. This year (1992), Salzburg plans to open one-way streets to two-way bike traffic and to equip its bike paths with distance and destination signs.

Graz (pop. 242,000), the capital of Styria, another of Austria's eight federal states (Laender), has adopted bike promotion measures as part of a coordinated strategy to reduce motorized traffic by 25 percent, pushing it back to the 1970s level at the end of the century. A city-wide survey determined that residents support the traffic restraint objective.

Last year, some 300 Austrian communities participated in a national bike-friendly community competition which has been going on for more than 10 years. A total of 35 jurisdictions in all size categories, among them Salzburg and three districts of Vienna were selected as prize winners based on their submissions of bike-friendly plans, designs and measures. The competition is sponsored by the local government association, winners are selected by a jury that includes representatives of cycle clubs.[5]

In Denmark, a major 3-year traffic safety research program on cyclists in urban areas is underway by the National Roads Directorate. New solutions in signalized crossings, intersection priority, painted cycle lanes and traffic circles (roundabouts) form part of the experiments with initial findings due next year. The current program follows a multi-year experiment to improve road safety for cyclists and pedestrians along through roads in three pilot towns using design and signaling elements. Significant speed reductions and environmental improvements were obtained and incorporated into a national program that aims to reduce the number of traffic injuries and fatalities by 40 percent to 45 percent before the year 2000. The

[3] Stadt fuer Fussgaenger, Vienna, 1985, p. 50, reference #3.
[4] Letter, Dr. Brandstetter, 12/11/91, p. 50. reference #2.
[5] V.P. Kallberg, M. Salusjaervi, p. 51, reference #27.

Danish Cyclist Federation, whose membership topped 30,000, has effectively lobbied for improved safety and bike path construction programs.

An earlier research program at the beginning of the 1980s, investigated the impact on traffic accidents of speed reducing measures in two types of residential streets subjected to drastic speed reductions. In one case, authorized speeds were lowered to 15 km/h (9 mph), in the other to 30 km/h (18 mph). The control group consisted of all the other local government controlled roads in Denmark where the standard urban speed limits had been maintained. The before-and-after period was 3 years each.

On the 30 km/h streets, the number of accidents declined by 24 percent and the number of casualties by 45 percent, while no significant changes were found in the 15 km/h streets. The researchers found no reasons for this disparity.

Denmark has a biking tradition that dates back nearly 100 years and the bike is a national icon for Danes much as the automobile has become for Americans. Three quarters of the population own bikes. They start cycling at around 2 years of age and stay in the saddle for the rest of their lives. A golden girl on a bike even towers above city hall square in the center of Copenhagen. Following a dip in cycle use from the mid-1950s to the mid-1970s, half the population now makes regular use of the bike for commuting, shopping, day trips and holidays. Many seniors cycle in Denmark, and almost all children use their bikes every day.

Nationally, Denmark's 5 million inhabitants now account for 5.5 billion kilometers (3.42 billion miles) in bike and moped use annually (1988), more than the 2.6 billion km (1.6 billion miles) estimated in 1975. The total is higher than the combined passenger mileage of the nation's trains and more than 10 percent of the 50 billion passenger kilometers accounted for by cars. The modal split nationwide amounts to an impressive 19 percent. The Road Directorate is responsible for the maintenance of some 4,600 km (2,800 miles) of cycle paths along major roads.

Current design guidelines call for a coordinated bike path network with residential neighborhoods connected to the main path network by local paths. Divided bike and pedestrian paths are the rule when there is substantial traffic; shared bike and pedestrian paths are used when there are lower traffic flows.

When cycle paths with a separate alignment from main roads are not feasible, the guidelines call for one-way bike paths on both sides of mixed traffic roads separated from both the roadway and existing sidewalks. Bike paths shared with sidewalks and separated from them by painted lines or different surfaces only are limited to low traffic areas. On main roads with heavy traffic flows, dual paths on both sides of the road may be authorized with special provisions for signal light-controlled intersections.

Pedestrian zones, such as shopping streets, are closed to car traffic, but may be authorized for cycle traffic along certain stretches where there are no alternative satisfactory routes that can be allocated to cyclists.

The bike and pedestrian path guidelines form part of a ten-volume series of road standards completed in 1991. The entire series emphasizes approaches that promote traffic calming and traffic safety objectives, with an entire volume devoted to "speed reducers." The complete series accompanies this report. Volume 0, "Road Planning in Urban Areas," and Volume 7, "Speed Reducers," have already been translated into English; other translations are expected to follow.

In the early 1980s, a study conducted by two researchers in Finland, commissioned by the Nordic Council of Ministers, took a comprehensive look at "before" and "after" accident statistics along combined pedestrian/cycle paths built between 1971 and 1978 in the Scandinavian countries. The objects of the study were bike paths running alongside main roads and separated from them by a space of at least one meter or by a safety fence.

The study determined that the total number of fatal accidents and injuries decreased on average by 14 percent after the building of the bike paths. As expected, the number of accidents involving cyclists and pedestrians decreased the most, while the number of motor vehicle accidents remained unchanged. The most significant reductions in accidents were noted at night and outside built-up areas. The study covered Denmark, Finland, Norway and Sweden. [5]

A great deal of discussion and 5 years of engineering expertise have gone into the development by Norway of new guidelines on the construction of bicycle and pedestrian paths along national highways, integrated with traffic calming measures. There are currently about 2,000 km (1,243 miles) of bike paths along Norway's national highways, and many more along other types of roads. We are advised by the Norwegian Public Roads Administration that the national government pays for the construction of bike and pedestrian paths along the national highways, while county governments are responsible for the rights of way, where required, and for the maintenance of the paths.

The new design guidelines, adopted earlier this year, have been drafted by a ten member committee of senior engineers in the Directorate of Public Roads. They call for bike/pedestrian paths segregated from main roads and classify roads according to 12 standards. The guidelines aim for the construction of uninterrupted routes for pedestrian and cyclists that are linked to public transport terminals, are amenable for elderly and handicapped, and connect residential areas with center cities and recreational destinations in the suburbs.

Integrated traffic calming measures, pursued in tandem with bike/pedestrian path construction, call for a standard range of design techniques to effect speed reductions on roads with a traffic volume below ten thousand vehicles daily. Speeds of only 20 km/h (12 mph) are called for in residential neighborhoods, with neckdowns, medians, traffic islands, speed bumps and rumble strips as some of the suggested design tools. Road markings, plantings, changes in pavement surface composition, traffic signs indicating protected residential neighborhoods and

pedestrian-scale lighting fixtures to illuminate the speed-restricted zones, are some of the standard techniques detailed by the design guidelines.[6]

The Netherlands is currently (12/91) in the process of finalizing a national bicycle policy, to be known as the national "Master Plan: Bicycle." Together with the "National Environmental Policy Plan," the coordinated public policy approach to be implemented starting in 1992 will work towards substantial shifts in the modal split. About a quarter of all local trips, on average, are to be made by bicycle. The cycling master plan has a time horizon up to 2010, and in conjunction with other traffic and environmental measures, aims to have bikes account for more than 5 billion kilometers annually by 2010, a 30 percent increase, and a corresponding reduction in the projected growth of trips by private automobiles in the Netherlands.

The plan also aims to get more people onto public transport by improving the bicycle/public transport connection. The projected 15 percent increase, representing at least 1.5 billion additional passenger train kilometers by 2010 over 1990, will be due to improving bike path access to and from commuter stations, along with the improvement of bike parking and storage facilities.[7]

A country of 14 million people with an estimated 12 million bikes, the Netherlands already represents an enviable level of bike access to public transit. Of the 300,000 plus commuters carried by the National Railways on an average workday, some 140,000, or nearly half, travel by bike from home or work to and from their commuter rail stations. To cope with this onslaught, the railways offer a choice of guarded or unguarded bike storage facilities at every one of the nation's 351 railway stations. All of the parking spaces, whether guarded or unguarded, are located within a hundred meters (328 feet) of the station entrance.

Underground and multi-story bicycle parking garages have been constructed at a number of railway stations that get heavy use by commuters. Sites were selected cooperatively by the Ministry of Transportation and Public Works along with the Netherlands Bicycle Federation. A 1986 report cited a total of about 175,000 lockable bike storage spaces near station platforms, with daily occupancy reported in the 70 percent range. A special year-round "rent-a-bike" service, which allows commuters or casual travelers and tourists to equip themselves with a bike at their destination stations for a nominal daily charge, is also operated by Netherlands Rail. Six Dutch railway stations served as national demonstration sites in the early 1980s for a pilot program to increase bicycle access to the rail network through further targeted improvements of parking and access routes.[8]

High-quality urban cycle routes built as national demonstration projects exist in a number of Netherlands cities, notably Delft, Groningen, The Hague and Tilburg. The government also contributes to bike path construction by the provinces and municipalities under various matching formulas. In total, the Netherlands is reported to be spending more than 10 percent of the capital outlay for roadways on bikeway construction and associated projects.

---

[6] Directorate of Public Roads, Guidelines, p. 54, reference #58.
[7] Letter, J. van Hekke, Embassy of Netherlands, p. 52, reference #44.
[8] M. Replogle, New Links to Transit Markets, 1983, p. 57, reference #95.

The major bikeways are almost fully separated from motor vehicle traffic and pass through the downtown shopping districts. At the VELOSECUR 90 Conference, Groningen transportation director Dr. Van Werven reported that an astonishing 55 percent of workday commuting in his city is now done by bicycle, encouraged, no doubt, by recently-adopted parking standards, which permit a maximum of only one commuter car parking space for every four employees.

Traffic accidents have declined by one third in the city center, probably as a result of lower traffic volumes. (While vocal opponents of this restrictive parking policy predicted a sharp decline in economic activity in the city as a result, current trading levels are reported to be the best in the whole of the Netherlands. Record land value and tourism increases have been reported.) Groningen, with a metropolitan area population of 270,000, is now organizing a bike-based regional commuter plan with the cooperation of 26 nearby communities and its adjoining two provinces. Delft reports that bicycles are currently used for 43 percent of all trips in the city, other than those made walking. The national government and the city spent the equivalent of $38 million over 5 years to put its impressive bike path construction plan and associated measures into effect.

The European record for bike use may be held by Houten, a Dutch "new town" near Utrecht with a population approaching 30,000. An astonishing total of nearly 80 percent of all journeys in the town, not accomplished on foot, are reported to be made by bicycle. Planned around the bicycle as the main transport system from the beginning, with cars in a strictly secondary position, Houten features a dense network of cycle routes, giving good access to all destinations within the town. Cycleways cross the one main ring road using underpasses. The human-scale new town now in its final construction phase, appears to be realizing the ultimate potential of cycle use.[9]

Innovative features characterize most of the major Dutch cycle routes. The bikeways themselves are paved with a distinctive purple asphalt, and their surface is raised slightly above the pavement surface for easy identification. Cycle paths and routes are between 3 and 5 meters wide, and pedestrians are separated from cyclists.

The Delft scheme, subsidized by the national government, covers the entire city and provides for a logically organized three-tier cycling network. It consists of an inter-district system connecting the urban districts, a district network for short intra-district trips and a neighborhood network which serves individual homes and connects with the other two systems. As part of the scheme, one way streets have been opened to cyclists in both directions, new and existing cycle paths were asphalted, and signals installed at intersections. As a direct result of the improved network, the proportion of journeys made in Delft by bikes has increased from 39 percent to 43 percent and the average trip distance increased by 8 percent to 3.9 km (1985).

[9] Proceedings, Velo City 87, Gronigen, p. 57, reference #106.

The 10 km Hague demonstration project features intersection priority signals for cyclists and driver-alerting pavement texture changes in front of intersections. Road signs advise both cyclists and drivers of approaching intersections, and instruct the driver to yield to cycle traffic. Traffic and safety islands are also set up on the medians to allow phased left turns by both cars and cyclists. At most places where cars cross the cycleways, neck-downs and gentle ramps were built, using cobblestones and special markings alerting drivers to the presence of cyclists.[10]

Traffic Safety Initiatives

Starting in Delft (Netherlands) in the mid-1970s, the "woonerf" concept of a protected residential environment with street space shared equally among pedestrians, cyclists and cars "proceeding at walking pace," came into widespread use, first throughout the Netherlands, then in adjoining countries, especially western Germany.

The initiative was started by citizens because of the high rate of traffic accidents involving children at play in their neighborhoods, darting out into the street from between parked cars. By 1983, some 2,700 "woonerven" neighborhoods had been constructed and the number of accidents involving injuries had been reduced by about half. National surveys commissioned by the Transport Ministry reported that 70 percent of the population considered these protected neighborhoods to be attractive or highly attractive. Residents appreciated the low traffic volume and near absence of through traffic and a majority was in complete agreement with the restriction on cars.

Characteristics of the protected residential precinct include the abolition of continuous curbs and pavements, and speed-reducing techniques such as shifts in the line of sight of the road together with changes in the profile in the form of ramps and speed bumps. Narrowings that allow bikes to pass, but not two cars are a frequent feature, along with "vest pocket parks" and play space created in the thoroughfare through the placement of trees, planters and street furniture. In contrast to the flowing designs of fast roads, arrangements are angular and of pedestrian scale. Improving the mutual visibility of users is a priority criterion. For example, rows of parked cars are not allowed so that children cannot dash out unseen. Entrances and exits for the protected zone are clearly marked, of late by a European Community-approved sign, so that there is no doubt that different rules for traffic behavior apply in the protected residential neighborhood known as a *woonerf*. There are no official guidelines mandating "woonerf" size but on average they include two or three linked residential streets, forming a distinctive neighborhood.

To reduce traffic accidents and improve pedestrian and bikers' safety, the Netherlands government also introduced 30 km/h (18 mph) speed reduction zones throughout the country as a national demonstration program. A 1990 assessment of the experience involving 15 such zones, determined that 85 percent of all drivers

[10] EC Directorate General for Transport, p. 57, reference #107.

stayed below the new speed limit, and that the imposition of the restrictions led to a reduction in both the speed and the volume of through traffic. Besides signposting, the lower speeds were enforced through design and engineering measures such as neckdowns and narrowings, entrance constructions and partial barricades. Residents were universally in favor of the speed limitations. While accident statistics are only in from two of the zones (Eindhoven and Rijswijk), these bore out the expectations of lower figures, an experience the evaluators consider likely throughout the area when collective data are compared from all 15 demonstration areas.[11]

In mid-1988, the Netherlands government amended its legislation to give a wider interpretation to the "woonerf" concept, extending it beyond residential areas to cover pedestrian zones, city centers and places of historic interest.[12]

In North Rhine-Westphalia, the most populous state (Land) of Germany between 60 and 70 new pedestrian zones are being added to a nationwide total that is estimated to be well over a thousand. The pedzone program, a success from its beginnings in the late 1960s, initially showed a few growing pains such as traffic-overloaded side streets and a decline in retail trade along shopping streets adjacent to the zones. These have now been solved, in many cases by the phased enlargement of the zone and a seamless transition to adjoining traffic-restrained residential neighborhoods.

(Germany's pedestrian zones, in essence pedestrian shopping streets, have also had a positive impact on the retail environment and have brought gains in the quality and assortments of goods and services. Initially opposed by merchants, they are now an integral part of the urban scene in most German cities and have been accepted as a permanent part of the cityscape by shop owners and residents. The most successful have registered marked revenue gains, and are characterized by an extensive network of streets and squares incorporated into the zone and its effective integration into a city-wide public transit system.) [12]

The "Tempo 30" Program

A 3-year experiment in Germany, involving hundreds of speed restraint zones where maximum car speeds have been reduced from the standard 50 km/h to 30 km/h, have led to a change in the Traffic Code which now authorizes local authorities "to protect the residential population by the imposition of speed limits for clearly delineated zones inside cities." The change, due to the "Tempo 30" program, became official because the German Federal Road Research Institute has noted that the number of traffic fatalities involving pedestrian and bike collisions with automobiles decreased by almost 50 percent as a result of mandating speed reductions from 50 km/h to 30 km/h in the experimental zones. In actual numbers, this means a thousand fewer traffic deaths and 15,000 fewer serious injuries.

---

[11] RDTC *Woonerf*, 1980, A New Approach, p. 52, reference #46.
[12] G. Wynne, Learning From Abroad, p. 57, reference #96.

Partly as a result of these traffic calming measures, Germany has become much more cycle-conscious in recent years. Both the federal government and the German states (Laender) have supported various demonstration projects and hundreds of local authorities are cooperating and have launched traffic-calming measures of their own that benefit bikers directly, even without new bike path construction, because the guidelines have lowered urban traffic speeds throughout the country.

A study of its 5-year experience with the Tempo 30 program published by Hamburg last year, disclosed that traffic fatalities decreased by 28 percent between 1983 and 1989 in its 655 specially-identified zones as compared with other residential areas where the standard 50 km/h speed limit stayed in force. Overall, traffic accidents declined by 20 percent in the speed-restricted zones. As a result of this experiment, Hamburg is keeping the lower speeds in force and is considering their city-wide extension.[13]

Throughout North Rhine-Westphalia, there are currently some 2,400 speed-restricted zones, characterized by physical restraints to slow automotive traffic, that provide a more secure street environment for cyclists and pedestrians. Traffic calming measures along through roads are included in this total. The state government undertook a reconstruction program for through roads in the 1980s and is now applying the design experience learned to the development of improved design standards for new roads. In a before-and-after study, speed reductions were confirmed in a majority of cases. The evaluation showed that speed reductions were obtained more effectively from hard design elements such as changes in the road surface, traffic islands and roundabouts than from traffic signs and visual effects.

While the aim of the speed reductions brought about by the through roads redesign program was to lower traffic accidents, these were already on the decline during the "before" phase of the program, a decline that continued throughout the life of the program and its "after" phase. A direct connection could therefore not be established.

Another comprehensive study and literature search that has just been completed in North Rhine-Westphalia has come to the conclusion that regular, segregated bike paths of themselves do not reduce the frequency of accidents involving cyclists. Speed reductions for motorized traffic and the clear marking of separate surfaces for cyclists along main roads are a more effective means of reducing accidents. The only exceptions are well-laid out cycle routes, that are separated from other traffic, more than two meters wide, have good visibility and intersection priority systems. Such solutions however are quite costly and difficult to realize in practice.[14]

In summary, German research results indicate that segregated bike paths are no panacea as concerns safety, though they can be of help especially for inexperienced cyclists. Shared roads can be just as safe when space for cyclists is

---

[13] BfS Area-Wide Traffic Calming Results, p. 53, reference #53.
[14] ILS Dokumentation: Radwege an Strassen, 1991, p. 52, reference #51.

reserved by clear markings and signal lights are properly phased. In mixed traffic, the researchers found, road users tend not only to act more carefully, but also to reduce speed, a prime cause of traffic accidents.[15]

The integration of bike traffic into road traffic without separate bike paths, through the clear marking of sufficiently wide road surfaces reserved for bicycle traffic, has repeatedly been shown to slow down and calm motorized traffic. The study was completed in 1988 by the Urban and Regional Development Institute on behalf of the state's transportation ministry.[16]

Individual German cities that can lay claim to being the most bike-friendly in the country are also among the leaders of Europe's environmental movement. They include Erlangen, Freiburg and Muenster.

Nationwide, the number of bicycle trips in the western part of Germany has gone up by 50 percent over the past 10 years, and in several localities, including Bonn, cycling has doubled during this period, a trend that is generally spearheaded by university students. In Muenster, where cycling already accounts for more than 30 percent of trips, probably the highest proportion in Germany, the mayor and city council, noted for their environmental activism, aim to increase this to 40 percent while also introducing further public transit improvements. Muenster is considered the most bike-friendly city in Germany not only because of its proportion of bike trips. The number of bikes in this West German city exceeds its population (210,000), and the city's bike path network measures more than 200 kilometers.

In Muenster, local traffic management gives priority to cyclists. They are allowed to ride through the pedestrian precincts after hours, they enjoy dedicated left turn lanes at major intersections, and they benefit from progressive green lights at traffic intersections that are calibrated for bike rather than car speeds in some sections of the city. As a result, one-third of all trips in the regional city, and two-thirds among the student population now take place by bicycle.

The shortage of safe and convenient bike parking space has led to a city-funded, accelerated building program for lockable bike stands throughout the city. Consistent with its environmental activism, space for the bike lots has been taken away from parking spaces reserved for cars, an unlikely policy decision in most other cities.

Two other regional cities in Germany, Freiburg (pop. 172,000) and Erlangen (pop. 101,000) are devoting substantial resources to bike path construction, and have reached a traffic participation rate by cyclists of 29 percent, according to figures disclosed by traffic planners from the two cities at a conference last year.[17]

Reunified Berlin is the latest German city to push for an integrated bike path policy. It is investing more than DM 10 million ($6.4 million) annually in the extension of its bike path network which already amounts to an enviable

[15] ILS op. cit., p. 52, reference #51.
[16] ILS Schriften MSWV 22, 1988, p. 53, reference #55.
[17] Bonner Fahrradkongress, 1991, abstracts, p. 52, reference #52.

850 kilometers of which 50 kilometers were completed this year. The new 10-year construction program, which starts this year (1992) aims to build 12 through routes radiating from the center to the suburbs like the spokes of a wheel. They will be connected by eight suburb-to-suburb tangential routes. The plan was developed with the collaboration of Berlin's urban districts, the city's public works department and the local cyclists association. Parts of the former border strip along the razed Berlin Wall are expected to be included in the cycle path network.

Greater traffic safety, especially for vulnerable road users like cyclists and pedestrians, was also the aim of the 3-year "Safer City—Accident Free District" program conducted in France between 1984 and 1986. Monitored and evaluated in 1987 by an interagency committee the FF 140 million ($25 m) program was funded jointly by the national government and local authorities. It involved 56 local level traffic calming projects designed to lower speeds in urban areas and promote the traffic safety of cyclists and pedestrians. The safer city concept is now being extended to wider areas through the introduction of 30 km/h zones as in Germany.

The 1987 evaluation showed that the project's first phase brought about a clear diminution of traffic accidents along the 56 demonstration sites. An initial evaluation report, presented to the International Speed Management Conference in Copenhagen (May 1990), disclosed that the average annual number of serious accidents dropped by 60 percent along with traffic speeds. A comprehensive evaluation now underway is comparing the demonstration project results with the progression of traffic accidents generally. It is a fact that traffic accidents involving cyclists and pedestrians have declined steadily in France over the past 20 years. The reasons for this development have not been determined officially, but a diminution in the number of cyclists may be partially responsible.[18]

(There were 407 traffic fatalities among cyclists in 1989, as against 790 in 1970; while a total of 1,470 pedestrians died in traffic accidents in 1989, as against 3,180 in 1972. Unfortunately, the percentage of those under 14 and over 65 among pedestrian victims of traffic accidents remained consistently higher than the proportion of these age groups among the population at large. Those 14 or below make up 20 percent of the population, but 27.5 percent of accident victims; those over 65 represent 14.2 percent of the population, but 20 percent of the accident victims.)

The French "safer cities" program used as consultants two Dutch traffic planners prominently involved in the design of traffic calming projects in their native Netherlands. Joost Vahl and Jan Giskes shared Volvo's first international traffic safety award. They helped cities like Chambery, Rennes, Romans and Saint Andre change through-streets for safer use by cyclists and pedestrians by the tested redesign measures referred to throughout this report. These included cycle lanes and pedestrian routes, mini-roundabouts, visual or physical width restrictions, raised crossings, gate effects, planters and other street furniture and different paving materials. The large scale project included the turning of trunk roads into urban boulevards and local distributor roads in all four cities. Techniques included a

[18] Speed Management in Urban Areas, 1990, p. 57, reference #112.

planted central reservation, roundabouts, widened pavements and low lamp posts, all of which establish a pedestrian-oriented environment and drive the speed-reduction theme home to motorists. In the process, driving speeds were reduced from 100 km/h to 40 km/h (62 mph to 26 mph).

Pedestrian Amenities

The steady lowering of traffic casualties in France may also be due in part to the enthusiastic way in which most French communities have embraced car-free pedestrian zones. French towns of all sizes now have their own busy rues pietonnes (pedestrian streets), marked off with the characteristic curved stick man, shown in the photo, and dressed up with quality street furniture evidencing the view of elected officials that vandals stay away from urban space that looks good and is well-lit and carefully maintained. A number of French towns have also started to attach blooming flower pots to their custom-designed, pedestrian-scale street light fixtures to dress up the car-free zones that invite strolling, window shopping and the international pastime of people watching. City officials make the point that raised planters are easier to maintain, since they eliminate pilfering, vandalism and what is delicately termed canine pollution.

(There are now some 9 million dogs in France, one per five inhabitants, and walking the streets has in some cases become a pedestrian obstacle course. Provincial cities are now following the lead of Paris in contracting with half a dozen major national firms whose crews vacuum and flush down the pavements daily with high tech, high power water jets.)

These amenable pedestrian streets of France feature not only color-coordinated paved or pebbled surfaces, attractive fountains and modular sets of street furniture. They now display digital electronic message boards that have replaced the standard municipal information posters and signboards to advise the walking public of local cultural and recreational events or to communicate city hall announcements.

This trend towards improved pedestrian amenities that encourage walking in city centers is perceivable in most of the other western European countries. Its outcroppings include more public art and outdoor sculptures, well-tended seasonal flower beds and sidewalk decorations, along with playful, elegant street furniture with a post-industrial look that has replaced the severe functionalism of the early postwar era. Sanitized, sometimes automated, public comfort stations that are coin-operated and are looked after by contract crews, complete the picture.

Sweden, which extends for 1,500 km (932 miles) from north to south, can be considered bicycle-friendly along its entire length, at least during the summer. Swedes are enthusiastic cyclists, and there are more bikes in the country than its 8.6 million people. An estimated 80 percent of the population owns at least one bike, there are more than ten million bikes in the country and half a million new ones are sold each year. What is said to be the world's largest bike fitness race, the annual "Vaetternrundan," held in mid-June, brings together some 15,000 participants who

complete a 300 km (186 mile) course. The Swedish Cycling Federation estimates that 37 percent of daily commuters use the bike between home and work or school in good weather.[19]

Probably unique in its nationwide coverage is the "Sverigelenden," Sweden's national bicycle route, which traverses the entire country over a distance of 2,570 km (1,597 miles) and is posted over its entire length with some 5,900 green signposts. Clearly marked inter-city bike routes cover more than 14,200 km (8,823 miles) and a special feature of Sweden's bike orientation is the conversion of abandoned railway tracks to attractive cycle paths.

In the cities, the most innovative triple tiered cycling path network has been built incrementally over the past 15 years by Malmo (pop. 235,000), the country's third largest city after Stockholm, the capital, and Gothenburg. Malmo's bike path network was developed primarily to provide safe, direct and attractive alternative routes to the main roads used by cars. Malmo's urban bike network consists of 1) one and two way cycle paths alongside roads; 2) shared local roads for cars and bikes on which traffic is generally less than 600 cars daily, and 3) priority cycleways, signposted for bikes to which access is prohibited for motorized traffic. Malmo has devoted considerable resources to its bike path building program and now has 88 underpasses or tunnels under roads or railway tracks for the exclusive use of cyclists and pedestrians.[20]

In the United Kingdom, the lowering of accident rates rather than traffic calming or efforts to encourage the use of bikes for commuting, is one of the prime objectives of the Department of Transport (DOT). The Department feels that in improving safety conditions for cyclists, rather than stimulating cycling by direct means, it will encourage more people who are inhibited by concerns over traffic safety to take their cycles to the road. (Of course, the DOT notes that it is also working actively to promote traffic calming "in the context of improved urban safety.")[21]

DOT traffic policy officer S. Keswick wrote: "The Department's view is that whilst cycling is a healthy, economic and non-polluting mode of transport, it is also one of the least safe. Improving its safety is one of our priorities which may lead to more people being encouraged to cycle." Mr. Keswick added the Department also recognizes walking as an important mode of transit. "In 1989, the Department launched measures to improve pedestrian safety. In the past, the needs of pedestrians have been overlooked. There are now signs that engineers, planners and developers are showing greater awareness of pedestrian needs."

Urban cycling in the U.K. (pop. 55 million) plays a relatively minor role. Though some 11 million people own about 13 million bikes, only about one-fifth of these are in regular use.

---

[19] STB Discover Sweden By Bike, 1991, p. 54, reference #61.
[20] EC Directorate General for Transport, p. 57, reference #105.
[21] Letter, S. Keswick, 11/9/91, p. 54, reference #69.

The emphasis on safety considerations for cyclists and pedestrians in the U.K. stems from the fact that while annual traffic fatalities have declined by about 20 percent since 1975, the number of cyclists killed or seriously injured annually has increased by 23 percent over this period. A comparable situation prevails for pedestrian traffic casualties. Total traffic casualties have remained fairly constant over the past 15 years despite a one third increase in vehicle mileage. This connotes that cyclists and pedestrians are the most vulnerable group of road users.

An interdepartmental review of road safety published by the DOT in 1987 concluded that important gains in road safety could be made through low cost engineering measures, particularly for cyclists and pedestrians. The report noted that while there were no new, magic solutions, traffic casualty reductions could be achieved using well-tried and tested techniques. It called for research experiments and demonstration programs to identify techniques that can be used to create safer environments for cyclists and other vulnerable traffic participants. Subsequently the government set as its target a one-third reduction in traffic casualties by the year 2000.

Seven demonstration cycle routes, subsidized entirely by the national government, and ranging in cost from about $500,000 to $3,000,000, have been completed or are now being built under this program. They are located in Stockton, Bedford, Nottingham, Canterbury, Exeter, Cambridge and Southampton. In each case, safety innovations have been included in the design of the routes. In Stockton, a signaled cycle crossing operated by pressure-sensitive detection loops has been installed to help cyclists cross a heavily trafficked route and illuminated bollards mark the track as it passes under a main railway line. Another novel feature of the Stockton route is its "rails to trails" conversion of an unused rail line on a part of its alignment.

In Bedford, the route comprises a continues facility that includes converted footpaths, signaled crossings, urban segments, a riverside track, a shopping center and the first segment of a planned regional route network. Nottingham uses signaled crossings of trunk roads, counterflow lanes and segregated bike/pedestrian paths along its 30-kilometer regional network southwest of the city. Canterbury and Exeter involve recreational uses and a new cycle bridge that cuts travel time; the Cambridge and Southampton routes divert cyclists from two unsafe, narrow streets and provide alternatives to main roads that have been the scene of cycling accidents. A 20 percent accident reduction is aimed for.

An indication that the U.K. cycling demonstration schemes emphasize traffic safety over the promotion of usage and bike-based commuting is the relatively sparse use of the new bike paths that were completed in 1987 when these statistics were gathered. In Stockton, the number of cyclists on all routes into town dropped from 1,680 to 1,400 on an average work day after construction of the bike paths, of whom only 212 used the new route, while in Bedford usage increased by one-third to around one thousand.

In addition to the cycle routes demonstration program, cycling-oriented research, again with safety as the main objective, is included within the work

program of the DOT's research group, the Transport and Road Research Laboratory (TRRL) which disseminates its findings to local authorities and public interest groups by means of publications, films and videotapes. Those most recent and relevant to our subject accompany this report. The TRRL also was the lead agency in the Urban Safety Project which tried new traffic management approaches in five towns, again to reduce accidents. Results, published in 1990, demonstrate that new approaches to accident reduction as tested by the project could reduce collisions in urban areas by some 15,000 a year, resulting in lives saved and property damage reductions grater than $300 million. According to the findings of the project, traffic accidents could be reduced on average by 10 percent to 15 percent by reducing points of conflict between different categories of road users. Collisions at points where the most accidents had been recorded, the so-called "black spot" sites, could be lowered by a third.[22]

Until the mid-1980s when the Greater London Council, a metropolitan area regional council, was abolished in the course of a controversial local government reform, the London Cycle Project Team, set up by the Council, was organizing and redesigning cycle routes through the capital. The 19-person team of specialists was at work on 25 traffic safety-oriented redesign projects in the London area with Council funding equivalent to $3.2 million, when cycle route planning was returned to local authorities in 1985.

The U.K. cyclists' own advocacy group, the Cycle Campaign Network, has just published its own technical guide, titled "Cyclists and Traffic Calming." The publication takes a close look at 15 measures, identifying design detail to assist the cyclist. Highlights include: Pinch points should be designed with a "channel pass" for cyclists, materials must be carefully chosen to avoid deflecting or skidding of narrow tires. Signing should be clear, and illegal parking physically restricted. Above all, traffic calming, which is called "the most radical innovation in civic design for the next decade," must be an area-wide concept to avoid displacing traffic onto parallel streets. The guide was produced in consultation with the DOT to ensure that traffic calming benefits are maximized for the cyclist.[23]

Pedestrian safety, likewise, is the subject of 15 demonstration schemes that started in mid-1991 and will be monitored over the next 3 years by the University of Leeds. A joint project of environmental groups and local authority associations with support from the DOT, the demonstrations which go by the name of "The Feet First/A Step Ahead" will be the source of "Best Practice" notes, based on actual experience, to be issued and distributed by the University. In each case priority is being given to involvement of pedestrians and their advocacy groups in the planning process.

Improving pedestrian links, pedestrian access to city centers and environmental conditions for pedestrians are a prominent element in all of the projects. This is to be accomplished by a network of safe pedestrian routes in most of the areas, along with "resident-led road safety improvements." The footpaths in

---

[22] Department of Transport Cycling Bibliography, p. 55, reference #82.
[23] J. Cleary, Technical Guide, 1991, p. 55, reference #92.

residential developments which form part of the demonstrations are to be segregated from distributor roads and from heavily trafficked residential roads; they will be laid out so as to have the easiest practicable gradients, especially for the elderly and disabled, and they are to be protected as much as possible from rain, wind and snow. The guidelines state that they should be visible from dwellings and passing traffic, and well-lit after dark.

Another walking path initiative underway in Britain is the massive transformation of abandoned railway lines into new networks of shared footpaths and bike routes. A primarily pedestrian amenity, many of the walking paths connect old coal and steel towns in northeast England and communities in Scotland along the Ayrshire coast, linking Glasgow with the southern bank of Loch Lomond. The rails-to-trails movement is backed by local authorities such as the Devon county council which has also pioneered the traffic calming initiatives referenced elsewhere in this report. A Yorkshire plan is also afoot to link York and Liverpool, using sections of 20 abandoned railway spurs. The path will be 160 miles long and cross the Pennine mountain range which runs down the middle of England.

Much of the rebirth of the abandoned, overgrown railway tracks as a pedestrian amenity is due to a Bristol-based non-profit group, Sustrans, which has persuaded the Department of Transport and local governments that about ten percent of the 6,000 plus miles of track fallen into disuse since the 1920s could readily be turned into bike paths and walking trails. Sustrans has already built more than a hundred miles of paths. In so doing it has put to work about a thousand jobless people, drawing unemployment benefits from the government's Manpower Services Commission. By now, the program has turned about 30 abandoned regional rail lines into attractive walkways. Unlike roadways shared with motorists, these footpaths in the country are entirely safe.

The concern with pedestrian safety has accelerated in recent years when it became evident that the U.K. had one of the highest pedestrian fatality rates in the European Community. The U.K. pedestrian fatality rate of 3.1 per 100,000 population, for example, compares with a rate of 1.2 per 100,000 in the Netherlands. Children and young people below 14 years of age are especially at risk, since walking represents about half of all journeys for the 5 to 14 age group, and their true level of exposure to traffic risks is even higher if playing in the streets is included.

Britain's 20 Miles-per-Hour Zones

Traffic safety concerns were also at the back of Britain's decision to phase in 20 mph zones starting in early 1991. New guidelines established by the DOT restrict the speed reduction zones to access and distributor roads, generally in residential areas or along some shopping streets. As in continental Europe, the guidelines urge local authorities to consider the creation of a gateway effect at all entrances to the zone. While the zone signs will help to establish a gateway, they will not by themselves be sufficient to create a gateway effect. Narrowing the roadway at the entry point will emphasize the fact that a driver is entering an area of special

character, but again may not on its own be sufficient to reduce vehicle speeds. DOT Roads Circular 4/90 calls for speed bumps (known as road humps in the U.K.) to ensure a reduction of vehicle speeds at the entry point.[24]

Under the new rules, the zones must be of limited size with no place in the zone more than one kilometer from the boundary. The establishment of the zones is left to local authorities under traffic calming guidelines established by the DOT following a nationwide consultation in 1990. The results of the consultation showed overwhelming support for the establishment of the zones because traffic accidents on residential roads have killed or maimed an increasing number of pedestrians in recent years.

In launching the first of three speed limit zones in January 1991 in Norwich, where two traffic fatalities were recorded last year, Minister for Roads and Traffic Christopher Chope said "a pedestrian hit by a car at 30 mph has a 45 percent chance of being killed; at 20 mph the chance of being killed is reduced to 5 percent."

Besides speed bumps, sharp bends, plantings and staggered parking segments to break up long straight stretches that tempt drivers to step on the gas pedal, local authorities are experimenting with various types of bollards. Some of these can be controlled by a timer or can be retracted using a special key provided to street cleaning, delivery vans and emergency services crews. There are even state of the art bollards and access restraining ramps that can be raised and retracted with microchip-equipped "smart cards." The new interest in these access restraining devices has been triggered by youths who have used pedestrian shopping streets after hours to race cars and motorcycles.

The planners in the DOT have no monopoly on original thinking in the redesign of urban environments. County councils in the U.K. have been launching their own schemes to control the speed and behavior of traffic, make streets more amenable to pedestrians and cyclists, and return them to their neighborhoods. Leading the way in this area is the Devon County Council which looks after a massive road network of 8,800 miles, the largest in the U.K. Earlier this year, the Council published its own traffic calming guidelines in a profusely-illustrated hard cover book of 185 pages, drawing on Devon's experience over the past 10 years, along with examples gleaned by the county in a study trip to demonstration cities in France, Germany and the Netherlands. The volume, compiled by Edward Charlton, the county's engineer and planning officer, provides a close look at 19 different ways employed in the U.K. and western Europe of influencing traffic behavior in the interests of the more vulnerable traffic participants, that is to say cyclists, and pedestrians, especially the young and the old.

Charlton stresses the importance of involving the community every step along the way to gain acceptance of pedestrian, bike and traffic calming improvements. "These enhancement schemes," he says, "can contribute greatly to the quality of life, particularly in shopping centers and residential areas, by reducing vehicle speeds and restraining traffic flows." The illustrations show

[24] DOT Circular 4/90: 20 mph Speed Limit Zones, p. 55, reference #84.

arrangements to help pedestrians and cyclists, including foot and bike path construction, road narrowings, entrances and gateways, special pavings, plantings and street furniture.[25]

[25] Devon County Council: Traffic Calming, 1991, p. 55, reference #90.

Non-Design-Related Safety Initiatives

The Helmet Debate

Bike helmets are probably the most widespread safety appliance available to and used by cyclists for their personal protection in the United States. We have no figures on the extent of their use in Europe, but subjective visual evidence indicates that they are used to a considerably lesser extent than in the U.S. The unpopularity of bike helmets among European cyclists is shared officially by the European Cyclists Federation (ECF) which represents 21 member groups in 15 countries that speak for many million of cyclists in Europe.

The ECF recently told the World Health Organization that while it fully supports the aim of making cycling safer, it has a serious problem getting behind the promotion of helmets for cyclists, which is a WHO objective. The bike helmet initiative was called for by the Division of Injury Control, part of the U.S. Center for Disease Control in Atlanta, the lead agency for the WHO project. It aims to produce evidence "which may call for better protection of cyclists through helmet wearing," in the words of Dr. C.J. Romer, chief of the WHO Injury Prevention Program.

The ECF takes the position that safety helmets:

- do not prevent any accidents and only occasionally reduce the severity of their consequences;
- make cycling less convenient, thereby discouraging people from using bicycles;
- are not a cost-effective way to reduce injuries compared with other measures, such as education programs for cyclists and other road users; and finally that they
- tend to shift the responsibility for road safety onto the shoulders of potential victims and away from those likely to cause a safety hazard, mainly drivers of cars.

In support of its position, ECF cites reports from Australia where a law that made the wearing of a bike helmet compulsory seems to have led to a reduction in the number of cyclists. For the ECF and its member groups which promote increased cycling, compulsory helmet laws are counter-productive.[26]

[26] ECF Correspondence with WHO, 1991, p. 57, reference #110.

This debate is likely to drag on for years but the attitudes summarized above are unlikely to lead to a more extensive use of bike helmets in Europe unless these are made compulsory, or "fashionable" among peer groups.

In the latter context, we have seen a press report from a suburb of Copenhagen, where the police chief has persuaded a voluntary organization to provide every third grader a bike helmet. The idea is to make the safety helmets fashionable and to mobilize peer pressure in their behalf. The idea came from a police/community liaison group. A police spokesman notes that both grownups and children have now started wearing helmets. "We could have spent lots of money on pamphlets and made many speeches, but it would not have had the same effect," says the town's social services director.

On Reflection

While the helmet issue is controversial among European bikers for the reasons cited above, reflective devices are widely accepted and appear to get greater use throughout the continent than in the U.S.

Starting in Finland in the 1970s, and extending to the other Scandinavian and Western European countries in short order, reflecting spacers, mounted on the left seatstays of bikes, have played a role in preventing traffic accidents involving cars and cyclists as indicated by research reports from Finland and the U.K.

The flexible, hinged bike spacer, sporting a red reflective disk in the back, a yellow or white one in front, is clearly visible at a distance of several hundred yards. It extends about sixteen inches to the left of the rear wheel and is folded alongside the wheel when not in use. When fully extended, the spacer forces drivers to give bikers a wide berth. As far as we have been able to determine, the device was initially introduced in Sweden in the 1970s and several million have been sold by now at a nominal cost, reported in the mid-1980s to range from three to five dollars.

These reflecting safety devices have also been tested and recognized in official guidelines or ordinances of several countries, including, as far as we have been able to determine, Finland, Germany, Switzerland and the U.K. The Central Organization for Traffic Safety in Finland concluded after a nationwide study that "vehicle drivers give more way to bicycles fitted with a safety pennant than to those without such a device." Lower accident rates were also reported in a 1975 study when the pennant was introduced in three Finnish communities. The German Ministry of Transportation published national performance standards for the spacers back in 1981 (VkBl1981 S.148). These required a maximum length of 40 cm (16 in.), double reflectivity, a folding hinge, and the use of splinter-proof materials. Reports that the spacers were widely used also reached us in the early 1980s from France and Switzerland.[27]

---

[27] Liikenneturva: Use of Warning Pennants, 1972, p. 51, reference #28.

(The reflecting devices were tested in the U.S. in the early 1980s and several thousand sold to bikers through ads and cycle clubs. A report in Bicycling Magazine at the time noted their reflectivity up to 500 feet when they were "visible by low beam and reasonably conspicuous on high beam.")

The only reported municipally-sponsored use of the Finnish device in the U.S. took place in Charlottesville, Virginia in 1981. The author of this report made the spacers available to Charlottesville. The city's director of planning (S.S. Huja) wrote us in mid-1982 that "the number of bicycle accidents in the City of Charlottesville decreased from 30 in 1980 to 13 in 1981, which was the first complete year of the (bike safety) program and the year the bicycle spacer was introduced."

While a causal link was not clearly established, the official felt that the spacers were responsible for the decline, at least in part. A press release issues by the city on July 15, 1985 states in part: "It is the opinion of the Charlottesville Bicycle Safety Program that the spacer can be an effective means to assure adequate protection for bikers if properly promoted and used." [28]

In the United Kingdom, the Transport and Road Research Laboratory (TRRL) tested the devices in 1984 when they were given to students aged 11 to 16 throughout the Manchester metropolitan area. After three weeks of use, the students were invited to complete a questionnaire on the spacers' effect on the cyclists perception of their traffic safety. Of the respondents (349, median age 13) 85 percent noted that overtaking vehicles gave them a wider berth than bikes not so equipped, and three quarters of the respondents thought that the presence of the spacers had reduced accident risks.

Tests using an ultrasonic device to test the passing distance of overtaking vehicles were also carried out. The author of the TRRL research report states: "Using a spacer 0.5 meters in length the percentage of overtaking vehicles passing less than 0.8 meters from the cyclist was about half that recorded when no spacer was present." [29]

Other types of safety reflectors are also in use in Europe. For example, the ADAC, Germany's automobile club, the counterpart of the AAA in this country, in 1991 endorsed the use of reflecting tires by cyclists to improve their visibility at night. All major tire manufacturers in Germany are supporting the safety initiative and are now marketing reflecting tires which cost only about $2 more than conventional bicycle tires. The low night time visibility of cyclists not equipped with reflective materials continues to be blamed for a major share of collisions involving cars and bicycles. Reflecting tire, reflective clothing and the reflecting safety spacers, pedal reflectors and pennants all help to improve bikers' visibility to motorists in front or behind them under nighttime driving conditions.

Improved nighttime visibility made possible by highly luminous or reflective clothing and accessories can be a life saver for pedestrians as well as cyclists. In the

---

[28] Charlottesville, VA: Press Release, 1985, p. 57, reference #104.
[29] TRRL Evaluation of Pedal Bike Spacers, 1984, p. 55, reference #93.

early 1980s, Britain's Royal Society for the Prevention of Accidents (ROSPA) in collaboration with the Sunday Mirror launched a nationwide campaign that distributed about three million reflective discs to school children and the elderly. Dangling from coat or trouser pockets, these discs, made in Norway, reflect car headlights and are visible in the dark from up to a thousand meters distance, nearly three quarters of a mile—compared to a normal pedestrian sighting range on a dark evening of only about thirty meters (less than a hundred feet). In Norway, a country of four million, about two million discs had been distributed by the time the idea caught on in Britain. The U.K. campaign aimed at equipping its 12 million school children and millions more of adults, especially senior citizens, with the simple safety gadget, distributed in most cases without charge due to commercial sponsorship.

Since the introduction of the disc in Norway in the late 1970s, the number of pedestrians killed or injured in nighttime road accidents dropped by a dramatic 45 percent, or about 400 in a typical year. Doctors in Norwegian hospitals were reported as noting that the few persons who are still knocked down by cars at night, were not using the reflective disc. The British experiment was similarly aimed at reducing the number of pedestrians killed or maimed in road accidents during the hours of darkness. The total was in the range of 19,000, and, according to ROSPA statistics, included more than 1,200 children under 15. Bought in lots of 10,000 by public-spirited firms, and sometimes marked with the donor's logo, the discs were distributed free of charge to clients and customers. London's Westminster Bank, for example, sponsored 100,000, and McLeans Toothpaste offered them free of charge in exchange for a coupon on the back of the toothpaste's cardboard tube packet. Insurance firms, building societies, automobile clubs and department stores also acted as sponsors. The lots of 10,000 were sold to sponsors in Britain for the equivalent of about $2,400.

Cyclists' and pedestrians' safety is also enhanced by audible signals and/or headlights that give advance warning bikes are coming. While only a fraction of U.S. bikes appear to be equipped with such bike-mounted warning bells or chimes, these are standard equipment in Europe, along with bike headlights that are either battery-operated or powered by a generator that draws its energy, when engaged from the turning of the rear wheel. In some countries, for example the Netherlands, warning bells are compulsory.

Physical Security—Bike Theft

Bike theft is a major problem throughout Europe, especially in those cycle-friendly cities where there are a lot of bikes around at all hours of the day. Local authorities have come of with a variety of imaginative schemes to cope with the problem. Several cities in the Netherlands and Sweden are providing better storage and lockup facilities; communities in Denmark, Switzerland and the U.K. are seeking to reduce or stop thefts by making bikes generally available and allowing people their free use in city traffic.

An innovative type of space-saving contraption is reported from Malmo, Sweden (pop. 450,000) where bike thefts reached 25,000 a year, nearly a quarter of the national total. The experimental bike lockup is in fact a cage that completely encloses up to 12 cycles in adjoining wedge-shaped compartments. The whole circular contraption has a diameter of about 12 feet. Tightly meshed metal doors with latches and locks are provided for each compartment. Besides providing security, the compartments, which rent for about $3 a month, also protect bikes from rain and snow.

Fighting both bike theft and downtown congestion is the latest initiative by Muenster, Germany's unofficial bike capital, referred to previously. The city is building lockable covered "Park and Bike" boxes along the edge of peripheral parking lots where commuters will store their personal bikes. They will switch every day from their cars to their bikes to complete the trip into the downtown area, and reverse the procedure every evening on the way home. The city council bought the idea on economic grounds, not just because of the community's bike-friendly orientation. A quality bike box at the edge of town costs taxpayers about $2,500, whereas a covered parking space in a downtown municipal parking garage can range up to $38,000 depending on location.

Bike theft is an even bigger problem in an adjoining smaller country. Police reported that just over a hundred thousand bikes (101,288) were stolen in Denmark (pop. 5 million, cyclists 2.5 million) in 1989, representing a loss of nearly $2 million. There, a public private coalition has come up with a different plan—free rides for everyone. More than 5,000 bikes, carrying advertising from sponsors reportedly were placed in 900 bike racks throughout the city in 1990. The Copenhagen city council which has a special interest in reducing bike thefts, along with pollution and traffic congestion, has authorized the placement of these cycle racks on almost every other street corner. Eight companies have put up the equivalent of $1.7 million needed to launch the Copenhagen project.

The clumsy-looking cycles are convenient to use to get around the city, but discourage would-be thieves because their non-standard parts do not fit other bikes. They are colorful, easily spotted, and designed so that no one would steal them. Sponsors' advertisements are suspended from the bikes' big, flat central tubes.

The two organizers of the project plan to test their plan next in Paris and Rome where authorities are trying to discourage the use of cars in city centers.

A similar free bike plan was put into effect in Amsterdam in the 1970s, but did not live up to the sponsors' expectations. However, "Take and Ride" bikes are operating successfully at the Hoge Veluwe national park in the Netherlands, where visitors can pick up a bike without charge when they enter and drop it off anywhere on the grounds.

On a much smaller scale, 30 free bikes were placed in six racks in Exeter (U.K.) in mid-1991 for the use of the public in a cooperative project between the police and the Devon Probation and Social Services department. In this case thefts would be deterred, organizers hope, because the bikes will be old, reconditioned and painted a "horrendous" green color. (The need for disincentives to the theft of free bikes becomes obvious considering the experience of Bristol, elsewhere in the U.K., where reconditioned bikes without any special paint or markings were offered free of charge. Every single one was stolen, reports the London Evening Standard 9/13/91.)

In an innovative wrinkle, young offenders, sentenced to community service, will help to restore the cycles, acquired at a nominal cost from police lost property departments by the department. Reducing the number of bike thefts in Exeter, which average about ten a week, by providing free bikes, police feel, will also help avoid criminal records for some spirited kids who were previously caught joy riding on stolen bicycles.

Organizers hope to increase the number of bikes available to one hundred in the course of a year. A police spokesman for the project said: "We expect some bikes will be damaged or go missing, but hopefully this will be limited. If the bikes are taken out of town, then we hope someone else will hop on them and ride them back in again. They are all coded and have stickers which are very difficult to remove and the lime green color is so horrendous that no one would want it in their garage."

For the past 5 years, the social affairs department of Geneva (Switzerland), the country's second largest city, has worked with a local voluntary organization to make available for public use, reconditioned bikes painted pink. Geneva's pink bikes—at last report there were about 160 on the city's streets—get a lot of use by students and teenagers. They are often in need of repair, but theft or vandalism does not seem to be a major problem.

Swiss local government administrations generally require bicycles to display small license tags, registered and issued under the authority of the cantons' police agencies. The 27 self-governing Swiss cantons exercise the powers of states and counties in the U.S. The law-abiding nature of the vast majority of Swiss nationals, along with the registration and license plate requirement may serve as a deterrent to bike theft given the official character of the license plate. At any rate, unlike most of the other European countries, bike theft does not seem to present a major problem in Switzerland, one of only a handful of countries in the world that require government-issued license tags for every bicycle.

Bicycle Access to Public Transit

Historically, the suburbanization of Western Europe in the postwar period and the increase in personal mobility represented by car ownership, have resulted in a marked growth of "park and ride" as well as "bike and ride" trips to suburban commuter rail stations. In some German bedroom communities bicycles now account for nearly half of station access trips, a trend that is also evident in the Scandinavian countries. To accommodate this shift in living patterns, transit agencies, railroads, government and the private sector have all contributed to the development of bicycle parking facilities at rail and bus stops throughout northern and western Europe.

In Germany, bike parking at suburban commuter stations is usually the responsibility of the local public transit operator. When one gets further out into the countryside, and downtown in cities, however, it is usually up to local governments to provide bike storage facilities. German transit agencies often contract out the operation and maintenance of bike and ride (as well as park and ride) lots. In Denmark, the national railways (DSB) were responsible for all bike parking at stations until the 1970s when this responsibility shifted to local governments. In the Netherlands, the national railway (NS) through its subsidiary Servex, along with private contractors, are responsible for nearly all bicycle parking at railway stations. These private firms also offer bike rental, repair, parts and retail sales services at the stations.

The Dutch railways and local governments cooperate actively in planning for bicycle access to the stations inasmuch as the bike is the most popular feeder mode. On average 35 percent of all trips to railway stations are made by bikes, for commuters the percentage is even higher. Local authorities are responsible for the construction of the increasingly common underground bicycle parking facilities and access routes in the station area, while NS pays for the surface storage sheds and lockers. The national government provides major subsidies for both programs. Guarded bicycle storage is available at about 80 stations around the country, along with rental and repair services. Some suburban bus stops in the Netherlands and northern Europe also offer bicycle parking facilities.

Improvements in the station access system for bicycles have been accompanied by changes in the way passengers complete their trip. Besides continuing on to their workplace on foot, light rail, or bus, increasingly the bike is coming into use at the other end of the commuting trek. Surveys in the late 1970s showed that one out of twelve rail passengers in the Copenhagen region and in the Netherlands completed their journey with a second bike kept in storage at the exit point, or taken along on the train where permitted.

Major European commuter rail systems opened their door to bicycles in the 1980s, at least on a part-time basis. At last report a total of nine European metrorail networks now permit bicycles inside passenger cars and stations. Three systems—in

Amsterdam, Oslo and Paris—accept passengers with bikes at all hours, although in the Paris region this service is restricted to the suburban RER rail lines. Several other systems, including London, Rotterdam and Berlin, allow bicycles aboard during off-peak hours. Others currently restrict transport to weekends. These programs have all proved to be popular and trouble-free, with peak demand reportedly rising to around a thousand bikes on a summer Sunday in Hamburg. As a proportion of average daily ridership, bike passengers with their bikes account for 2,000 per million riders in Amsterdam.[30]

In recent years, European railways have also made increasing provision for the transport of bikes as accompanied passenger baggage. As noted above in the case of the Austrian Railways, separate compartments have been provided for bike transport, which is also the case in Switzerland. In Germany, passengers accompanied by bikes exceeded half a million a year in the 1980s, more than doubling the numbers of the previous decade.

Even more impressive increases were noted by Michael Replogle in Denmark where the number of passengers with bicycles on the National Railways (DSB) reached 700,000 10 years ago, a level corresponding to 10 percent of the entire population, compared with only 40,000 in the mid-1960s.[31] This trend is continuing. The DSB is also currently involved in a program of building weather protected and guarded bike storage facilities, so-called "cycle centres" at stations around the country. The first two have gone into service in Copenhagen. They are open from 6 am to midnight and offer repair and rental facilities as well as a snack bar/cafe and newsstand. In principle, all of the coming cycle centres will be staffed daily in accordance with daily train schedules. DSB has also worked with the National Cyclists Federation to develop a plastic "cycle consignment cover" for those who wish to send their bikes to another rail station within Denmark. The cover protects the cycle from transit damage on all domestic lines.

Sweden has concentrated on promoting cycling holidays. The Swedish State Railways (SJ) introduced special "bike trains" on 20 scenic routes in 1990. A promotional campaign aims to encourage passengers to bring along their two wheels on the train journey, for the equivalent of a extra eight dollars, to start their cycling holiday at the destination of their choosing anywhere in the country. Bikes and trains are a logical match, SJ says, because both modes are noted for being environment-friendly.

The Swiss National Railways (SBB) have concentrated on providing passengers with biking options for recreation and leisure, in addition to encouraging the use of bikes for station access. In some localities (Brugg is cited as an example) up to 40 percent of rail passengers use their bikes to reach the station. The SBB is now transporting bicycles as accompanied baggage on all its regional and commuter services, with free service under consideration for weekends to encourage their sports and recreational use, according to the Swiss Bicycle Federation.

---

[30] ECF Bicycles and Trains Project, 1991, p. 57, reference #107.

[31] Replogle, op. cit., p. 57, reference #95.

On congested inter-city trains where the SBB faces capacity problems, bikes can be carried, but only in baggage cars as unaccompanied luggage. Passengers on long distance services are urged to hand in their bikes at the stations' baggage forwarding windows if they will need the bicycles as soon as they arrive at their destinations. As an additional service, good quality bicycles, including mountain bikes and children's bikes can be rented at any manned SBB station on a so-called *Velokombi* ticket. Bikes are available for individuals, or the whole family at a single ticket cost of Sfr 44 ($29), or Sfr 96 ($64) for two adults and a child, which includes the bikes and unlimited travel for a day over the entire Swiss railway and the inter-city bus network operated by the Postal Service. Bikes can be picked up and returned at any manned SBB station. In recent years, total annual rentals have exceeded 80,000.

Juerg Tschopp, the spokesman of the Swiss Bicycle Federation told the International Bicycle Congress in Bonn last year (June 1991) that cycling provisions in Basel, Bern and Winterthur, include the right to carry bikes onto tramsduring off-peak hours. The Basel light rail system also rents clubs and groups special "bike and ride" trailers that holds 25 cycles and can be hired on weekends for a run into the attractive Alsatian countryside to the West. (In 1986, the Basel region, with a population of 426,000, accounted for 181,196 bikes and 144,541 cars according to official figures quoted by Mr. Tschopp; accidents involving cyclists decreased by approximately 50 percent between 1965 and 1985.)[32]

Recreational use of bikes is also promoted by the Austrian State Railways which have retrofitted 30 interurban electric cars to carry up to ten bicycles each in a converted dual use passenger compartment. The new cars coming into the system have the bike fittings as part of their standard equipment. Both the retrofit and the new versions have one passenger compartment per car with lockable doors, two upholstered folding benches and a bank of five retractable hooks above each bench. When the compartment is not being used to transport bicycles, up to six passengers can sit on the benches, and the hooks are folded up against the ceiling. The bike-friendly cars have been operating without incident since 1985 and have proved popular with the traveling public. Extra cost per retrofit car is about $3,500.[33]

Denmark's bike-on-train scheme, which started in 1983, was organized using the Netherlands experience. Initially it covered only eight stations, but was expanded incrementally, and by 1987 was extended to all long distance and metrorail trains seven days a week, except for rush hours Mondays through Fridays. (Besides bike-on-rail, Denmark has also pioneered a bike-on-taxi program. As far as we have been able to determine, Copenhagen is the only capital city where cabs are officially obliged to carry the passenger's cycle.)

Even more impressive in terms of size is the recreational day trip initiative of the Norwegian State Railways (NSB) which carries the bikes of 250 cyclists free of charge to the forests near the capital every Saturday and Sunday. The NSB sends two special bike trains every weekend to the forest town of Roa, northeast of Oslo.

---

[32] Bonner Fahrradkongress, 1991, p. 52, reference #52.

[33] Interview, PIA, 12/87, p. 57, reference #102.

From there, the cyclists take a pleasant ride back to Oslo on miles and miles of bike paths where no cars are allowed, through the huge forests north of the capital.

The bike goes along without charge on a passenger ticket that costs the equivalent of $6. The special train has passenger compartments, plus three attached baggage cars for the cycles. The program is the result of an agreement negotiated between NSB and the national cyclists association.

Support is also growing internationally for bike-on-rail programs. In the 1980s, both the UITP and the VoeV surveyed the transit agencies that make up their membership on their institutional views and practices concerning the carriage of bicycles on public transit vehicles. The UITP, headquartered in Brussels is the International Public Transit Association, the VoeV, Germany's nationwide association of public transit operators.) The UITP survey found no instances that required additional personnel or funds to carry on the bike-on-rail program, nor was it found to have been responsible for accidents or delays in operating schedules.

As a result of its own survey with a similar favorable outcome, the VoeV issued recommendations on dual mode travel to its members. It urged member operators to permit bicycles on all rail lines, with the exception of peak period, peak direction travel, and with conditions imposed on the number of bikes to be permitted per passenger coach.

Bike and Pedestrian Promotion Programs

Germany's "Towns for Cyclists"

Detmold (pop. 65,000) in North Rhine-Westphalia, and Rosenheim (pop. 38,000) in Bavaria, were selected back in 1981 by the German Federal Environment Agency as sites for the "Towns for Cyclists" 6-year national demonstration project. Nine other smaller and medium-sized West German cities were selected along with the two principal model towns out of a field of 131 bike-friendly applicants to serve as demonstration sites for one or the other subsidiary single projects such as testing new parking facilities or techniques to link bike traffic with public transportation modes. The ideas and experience gained during the 6-year model project have been made available to local authorities in Germany and adjoining countries in a three volume study to aid in their own bike promotion programs.

The Environment Agency provided financing for planning, monitoring and accompanying research work, while the respective cities remained responsible for their own programs and grant proposals to Land (state) and federal government agencies for subsidies under existing urban development programs which could be geared towards the promotion of bicycle traffic. Not only were the bike paths in the two cities extended respectively by 91 percent (34 km to 64 km) and 62 percent (21 km to 34 km); both towns put into effect an extensive catalogue of cycle-promoting measures which can serve other communities as a guide and reference installation. Included are:

- In Detmold:

  Raised cycle crossings
  Separate left turn lanes (both cities)
  Widened cycle paths to improve junction safety
  Signal-controlled bike obstruction at junctions
  Opening of dead end streets for cyclists
  Bike path along former tram track
  Combined bike/pedestrian paths in parks
  Publication of bikeway maps
  Signposting and information systems
  Opening of one-stop bike offices (both cities)

- In Rosenheim:

  Marking multi-purpose lanes on existing roads
  Marking cycle lanes on existing roads

Straight ahead lanes in lanes for right hand turns
Improved bike parking facilities throughout town
Setting up rental facility for bikes
Equipping city employees with bikes

The 6-year study resulted in some general recommendations for local biking policies to promote greater use, including a coordinated promotional approach beyond merely building more bike paths; such as the implementation of an integrated bike path network, and the fashioning of a municipal climate conducive to bike acceptance by the population at large. Some suggested moves involved "bike and ride" facilities, link-ups of regional bike path systems, authorizing bikes in public transit vehicles, and starting cycle rental outlets.

According to the model towns for cyclists study, these recommendations need to become part of a larger traffic calming approach by cities in order to reach their objective of significantly influencing the modal split. The reduction of speed limits in built-up areas, wide area traffic management and limitations on car parking in central cities form part of the comprehensive approach called for by the study.[34]

Improving conditions for bicycle traffic was also one of the principal objectives of another German demonstration and research program which placed traffic calming measures in test areas of small, medium and major cities. Denser cycle path networks were built under the federally-funded program in Borgentreich (pop. 2,300), Buxtehude (pop. 33,000), Esslingen (87,000), Ingolstadt (pop. 91,000), Mainz (pop. 105,000), and the Moabit district of West Berlin (pop. 1.9 million). The research areas, as is evidenced by their population figures, represented a variety of town sizes, locations and physical characteristics. Under the program, one way streets and pedestrian zones were opened to cycle traffic, new bridges and underpasses were built for cyclists and pedestrians and special markings/surfaces ahead or across intersections contributed to safer cycling. At the same time, speed limits were reduced drastically for automobiles to 30 km/h (18 mph).

Before and after assessments, which have been completed at the time of this writing for Borgentreich, Buxtehude, and Moabit showed that traffic restraints resulted in much slower car speeds as well as lower accident statistics in all the test areas. In some cases, average speeds were reduced by as much as 50 percent to 18.3 km (Berlin-Moabit) and 40 percent to 28.5 km (Buxtehude). In sum, fatalities and serious injuries in all three test areas dropped from a total of 101 before to 65 after the restraint measures, this includes a reduction of fatalities in the Berlin-Moabit test zone from seven to three. There were no traffic fatalities either before or after the installation of traffic restraints in the other two communities. Moreover, the studies of the three model areas revealed that cycle and pedestrian traffic increased substantially while the increase in vehicular traffic was slowed. Gains in bicycle and pedestrian traffic averaged between 20 percent and 30 percent while traffic noise dropped by as much as 7 dB(A).[35]

---

[34] Carmen Hass-Klau: New Life for City Centers, p. 53, reference #56.
[35] Kolloquium: Ergebnisse aus den Modellstaedten, p. 53, reference #55.

The well-publicized positive traffic calming and accident reducing results of these high profile, federally-funded projects have given confidence to planners elsewhere in Germany to adopt similar solutions to local traffic problems. For example, major street crossings in Nuremberg have been reconfigured to accommodate outdoor cafes and pedestrian-friendly squares, while in Freiburg, narrow pedestrianized streets with insufficient space for trees, have been greened by growing climbing vines along facades.

Within the biking community, the nationwide German Bicycle Association (AFCD) keeps city officials on their toes by a membership campaign to rate German cities for their bike friendliness. A rating questionnaire is made available to members by the German Biking Monthly. At the end of the biennial contest, the AFCD officially presents the winning city with its "Golden Wheel" award, making sure the award presentation gets some media attention. Representatives of the winning city are invited to visit a bike-friendly city outside of Germany to exchange experience with their colleagues, in addition to visiting tourist attractions. The bottom-ranked cities get the "Rusty Spoke" instead. To make participation in the contest even more interesting for its membership, the ADFC raffles off valuable prizes contributed by merchants among participants who have sent in their evaluation form.[36]

Advocacy and Training Initiatives

While the government of France conducted national campaigns to promote bicycle use and pedestrian safety until about 10 years ago, the devolution (home rule) laws of the early 1980s shifted responsibility predominantly to the prefectural and local levels of government. However, CETUR, the Study Center for Urban Transport, which is a subset of the Transportation, Housing and Public Works Ministry, continues to monitor the field and conduct research and study programs comparable to Britain's TRRL.

The Ministry also continues to be involved indirectly through technical support, representation on interagency committees dealing with traffic safety, and support of advocacy groups such as the recently-organized Club des Villes Cyclables (CVC), which can be translated loosely as the club of bike-friendly cities. Founded by eight medium size cities in 1989 on the initiative of the mayor of Bordeaux, the grouping now includes more than thirty communities in all regions of France, and it continues to pick up new members. Besides the CVC, which concentrates on medium-sized and smaller communities, the capital city of Paris has started its own bicycle commission which goes by the name of Les deux roues a Paris (the two-wheelers of Paris).[37]

The CVC, a public/private grouping which has already held three annual national conferences, is currently headed by Serge Morin, deputy mayor of Lorient, and administered by an executive committee comprised of the mayors, deputy

---

[36] Golden Wheel or Rusty Spoke: PIA, 6/88, p. 57, reference #102.
[37] Letter, CETUR, 11/5/91, p. 51, reference #30.

mayors or city councilors of major French cities noted for their environmental advocacy, among them Bordeaux, Toulouse and Strasbourg. Four national organizations with links to the government, among them CETUR, are also associated with the CVC. Its action program includes advocacy and information exchange, nationally and internationally, along with an ongoing dialogue involving government, the manufacturers and bicycle user groups. Among the specific objectives of the CVC are full bike access to public transportation, the authorization of right turns at traffic signals during the red phase of the traffic signal, and practical nationwide instruction programs on bicycle use for school children 7 years and older, with a "permit" for graduates. The issuance of nationally-registered license plates for bikes, as in Switzerland, is also an objective.

Currently the CVC is engaged in an educational lobbying effort favoring road sharing with cars along clearly marked bike lanes in the roadway, rather than segregated bike paths. The alternative is cheaper—FF 100,000 ($18,000) per kilometer of marked roadway cycle track, against FF 1,000,000 ($180,000) per kilometer of segregated bike path. The CVC also cites research in Germany, France and the Scandinavian countries, some of which is cited above, according to which shared roads produce fewer bike accidents than bike paths.[38]

The lobbying efforts of the CVC are also directed towards demonstration projects that would allow cyclists to use reserved bus lanes, and to enter one way streets in a counterflow direction. To let bikers breathe easier, the club proposes negotiations with truck manufacturers and the government to require vertical exhaust pipes for trailer trucks to have exhaust emissions directed upwards. This would end the truckers' exhaust gases being blown into the faces of bikers sharing their road space.

In Germany, the objective of bike traffic safety is also pursued through the schools by concerned German communities working in concert with educators and local police agencies. For example, the Bavarian capital city of Munich (pop. 1.35 million), the country's third largest after Berlin and Hamburg, requires all fourth graders to attend instruction classes in bike riding and study sessions to become familiar with traffic signs and signals. In the final of five two hour sessions which run from April to the end of November, students are tested for their bike handling proficiency and their recognition of traffic signs and signals. The practical sessions are taught by police department instructors, the regular teaching staff handles the sign recognition and theoretical portion. The program is conducted by mobile "youth traffic school" teams dispatched on a state-wide basis.

In a typical year, more than 90 percent of the children (96 percent of the 9,925 who attended in 1988) pass the test the first time; those who do not may repeat it the following year. Graduates get a bike "driver's license," a certificate and a safety pennant. In the rare instances where the tests are flunked by students 2 years in a row, the parents receive a letter which informs them of the fact and calls on them to continue supervising their offspring in city traffic. All parents are also

[38] Club des Villes Cyclables, p. 51, references #35, #36.

asked to check the bikes and equipment of their children regularly to make sure they are safe, come with all the necessary equipment, and are in running condition.

A regional approach to the promotion of bike-friendly cities was launched in Germany in mid-1991 when the municipal bike coordinators of the Rhein-Main metropolitan area met for the first time in Mainz and agreed on regular get-togethers. The planners also decided to coordinate their promotion approaches and to lobby for bike-friendly amendments to their respective state (Land) building codes. One suggested amendment (which has already been adopted by Berlin) calls on developers to provide bike parking spaces on new projects as a condition for the issuance of building permits.

Financial incentives are also used by some cities to promote bike use, especially among public employees. We have seen news items to this effect from England and Germany. The most recent comes from Bielefeld (pop. 320,000) in North Rhine-Westphalia where the city council voted to offer a "bicycle depreciation allowance," in the range of $100 annually, to those of its staff of 3,000 who agree to ride their bikes to work, and to use them on the job. Bike parking spaces are an extra incentive. Public agencies can also play a lead role in promoting the bicycle habit by putting their own employees and officials, including uniformed law enforcement officers, on the saddle. The sight of such official pedalpushers is becoming increasingly common throughout western Europe.[39]

City officials hold the view that the action, besides setting a good example for local firms, can help reduce downtown congestion and increase productivity. The productivity increase is rationalized by elimination of the daily stress involved in the hunt for car parking spaces for those who take up the city offer and make the switch.

Citizen Participation

Planning departments in European cities generally get the public involved in decisions affecting their immediate neighborhood. When car restraints and design changes are planned in an urban quarter, neighborhood residents are usually invited to give their input at meetings organized by the planning staff where the projected changes are usually described, discussed and displayed.

An innovative citizen participation initiative in Switzerland was organized and funded by the Touring Club Suisse (TCS) to give neighborhood residents an opportunity to experience proposed changes in their street first hand before they were translated into permanent pavement blocks, changes in road alignment, planters and street furniture. The experiment ran between 1981 and 1984 and brought the mobile "residential street set," for about a week each, to some seventy Swiss communities. In every case, local groups used the modular set to simulate the projected changes. Experimenting with the fake bollards, planters, simulated speed bumps, bike stands, astroturf, plastic tape (to mark parking spaces), tree cutouts

[39] City Compensates Staff for Bike Use, PIA, 3/91, p. 57, reference #100.

and benches gave residents a direct look at what was in store for them. In the course of the local exercise, alternative solutions could be tried on the ground, as an adjunct to the discussions, simply by moving the modular components of the street set.

Instructions that went along with the set included a sample press release, suggested text of invitational leaflets to hand out to residents and distributed to households, sample posters and organizational tips as to whom to invite and how to organize a neighborhood meeting around the topic.[40]

Cycling in Eastern Europe

While the preceding pages have shown a considerable amount of public attention and activity in Western Europe aimed at improving conditions for cycling and walking, the limited, anecdotal data available from Eastern Europe do not indicate a corresponding level of concern. The rate of motorization in the European Community which currently exceeds one car per household in some member states, is bringing intolerable levels of congestion and has created a favorable climate for the promotion of alternatives such a public transit, cycling and walking.

The emerging market economies of Western Europe which are now dealing with survival issues, have a different set of priorities. The rate of motorization is increasing rapidly from a base of about one or two per ten households. Those who can afford it are buying cars, the majority of the population is served by extensive if aging public transit fleets, and the bicycle as an alternative transport mode is largely ignored. This situation is unlikely to change quickly since the legacy of environmental neglect and degradation militate even against recreational uses of bikes in many parts of the countryside.

A report on transport and the environment by two British researchers produced earlier this year for Earth Resources Research in London, notes that private vehicle ownership is rapidly increasing throughout Eastern Europe, that road networks are in a poor state of repair, noxious exhaust emissions are high and bicycles are generally spurned as a transport mode.

Malcolm Ferguson and Andrew Rowell report that while about a third of all Poles own bicycles, polluted air and undisciplined drivers create poor conditions for cyclists, especially in the capital city of Warsaw. The situation is said to be a little better in Krakow, a major regional city of about 300,000 where residents use bikes, generally for short trips, averaging 2.5 km (1.5 miles). Environmental groups have been calling for the construction of bike paths, but have not met with success to date. The writers speculate that in the country as a whole the use of bikes is probably on the decline at present.

In Hungary, there are currently about 200 cars per 1,000 inhabitants and car ownership is increasing rapidly as are complaints about air pollution generated by traffic. Bikes are used to a limited extent outside of city centers and in the

[40] Touring Club Suisse: Mehr Sicherheit, Zurich, p. 54, reference #64.

countryside. In Budapest, the capital city, traffic congestion, illegal parking, dangerous driving and the lack of cycle paths conspire to keep all but the hardiest cyclists out of the fray. The city council has banned cycling on the Danube bridges connecting Buda and Pest because of traffic congestion and even most of the environmental groups do not support cycling.

The situation is hardly better in Czechoslovakia where Ferguson and Rowell report that air pollution caused by industry is so high that traffic generate pollution appears insignificant by comparison. Hardly any cyclists can be found in Prague, but in the flatter towns of Bohemia, cycles sometimes constitute as much as 20 percent of all traffic. Cycling is well-established in rural Bohemia and Moravia, but in the more urbanized areas of Czechoslovakia, the bicycle is currently not seriously considered as a means of transport.[41]

Networks and Experience Exchange

Europe-wide and international meetings that bring together bicycle activists, transportation planners, consultants and government officials serve to network experience and keep open channels of communication. Last year's International Velo City Conference in Milan, Italy was the third such global meeting. Earlier in the year, there were national conferences in Germany (Bonn) and France (Toulouse) with attendance by activists from neighboring countries. An international conference on Vulnerable Road Users took place at the beginning of the year in New Delhi (India). The 1990 international VELOSECUR conference in Salzburg (Austria) and on Speed Management in Urban Areas, Copenhagen (Denmark) attracted specialists from throughout Europe and North America. The Sixth Pro Bike Conference, organized by the Bicycle Federation of America in Arlington, Virgina during September 1990, brought together 300 participants from 30 U.S. states and nine foreign countries.

This year (1992), the Velo Mondiale Conference, which has as its theme "The Bicycle, Vehicle of the 21st Century," takes place in Montreal (Quebec, Canada), September 13 to 17. It follows the Second International Conference on Auto Free Cities which is scheduled for May 20 to 24, also in Canada (Toronto).

Throughout the year, national and international periodicals and clipping services, such as the Bicycle Network News (Philadelphia) are monitoring developments, spotting new trends and exchanging experience. Obviously the advocates are keeping each other informed. It remains to be seen to what extent decision makers in the public sector will be listening. A hopeful sign for bike activists: Some of the national associations and groupings, such as the *Club des Villes Cyclables* include and have even been organized by decision makers in the public sector with a pro-bike, pro-pedestrian orientation. Europe's 30 national cyclists federations—some countries have more than one—are cooperating and exchanging experience under the aegis of the European Cyclists Federation (ECF). A listing of member associations, including addresses, phone and fax numbers,

[41] ECF: Bicycle Research Report 20, p. 57, reference #109.

accompanies this report. The ECF, in turn maintains a network of associate members in North America. With the Danish and Dutch associations in the lead, the ECF is currently working on a report for the European Commission on practices relating to bicycles and trains. The report is due in September 1992.[42]

[42] ECF: Listing of Member Associations, p. 57, reference #111.

Conclusions

Innovations of Special Relevance to the U.S.

European practices in the promotion of improved bicycle and pedestrian usage that merit a closer look, and possibly adaptation in the U.S., abound throughout this report.

Speed Reduction Experience

First of all, there appears to be overwhelming evidence in European research and practice that drastic speed restrictions in central cities and residential neighborhoods coupled with physical restraint measures, have gained popular acceptance and are universally successful in lowering traffic accidents.

There is also increasing evidence based on multi-year research and demonstration projects that mixed traffic, in which cyclists proceed next to cars along clearly marked cycle lanes instead of along grade separated bike paths, leads to speed reductions. Drivers pay more attention in mixed traffic and cycle lanes in the roadway are much less expensive to install and maintain than separate cycle paths.

The only exceptions are well-laid out, wide cycle paths that are segregated from other traffic, have good visibility and intersection priority systems. Such solutions however are relatively costly and difficult to realize in practice.

There is a large and imaginative catalogue of European practices that make life easier for both cyclists and pedestrians and that have been tested extensively in practice for more than 20 years. These include counterflow lanes on one way streets, authorization to use bus only lanes where local conditions warrant, and such known design techniques as gateways, neckdowns, medians, traffic islands, speed humps, rumble strips and the slight buildup of bike paths above pavement levels for better visibility and possibly to improve drainage. Road markings, plantings, changes in pavement surface, warning signs at entry points to protected neighborhoods and pedestrian scale light fixtures to illuminate speed restricted zones, also help and deserve to get wider attention in the United States.

Pedestrian Amenities

Walking is encouraged by attractive, traffic-free street environments in numerous European cities with pedestrian amenities that include aesthetically-pleasing street furniture and plantings, meticulous street cleaning, civic art and

pedestrian scale illumination. Clean public comfort stations and such amenities as package checking facilities on public transit buses parked in pedestrian zones during holiday shopping periods, also contribute to the walking and shopping climate, as is evidenced by the commercial success of the pedestrian shopping streets in western Europe. These are not just linear, but extensive networks, lined with public transportation and fringe parking areas. Bikes are permitted in some of them.

Our current residential land use patterns and motorized lifestyle make it unrealistic to aim for a level of human powered transport commitment comparable to Denmark and the Netherlands with its unbroken biking traditions. We need to be aware, however, that national policies and practices to promote bicycling and walking in urban and suburban areas prevail in numerous European countries and that at least one (Netherlands) is reportedly spending as much as ten percent of its highway funds on bikeways and related projects.

The fact that attitudes are changing in this country is of course indicated by the National Bicycling and Walking Study which is responsible for the present review of European practice, as well as legislation requiring consideration of the needs of bicyclists and pedestrians.

Safety Enhancements

The traffic safety of both cyclists and pedestrians after dark is enhanced in Europe by a wide variety of reflective materials and devices. These include "bike spacers" and reflective discs for pedestrians used in northern and western Europe which increase visibility by a factor of ten or more. In the case of bike spacers, the reflective discs make drivers give cyclists a wide berth and have helped lower collisions and sideswiping incidents.

Safe riding is also promoted by instructional classes for primary school students, followed by tests and the award of a biking qualification certificate upon completion of the course, as is the case in Munich, Germany.

Improved access for cyclists to public transportation is another subject area in which U.S. transportation agencies and jurisdictions could look to Europe for guidance. Convenient commuter station access for bikes, guarded storage and bike lock up facilities at commuter train and bus terminals in the suburbs as well as downtown, and non rush hour opportunities to take bikes along on public conveyances, are among the bike/transit linkages common in Europe. Innovative cycle day trip marketing campaigns aimed at vacationing families and bike rental programs of national railway systems that facilitate bike-rail connections and help raise ridership are also impressive.

Promotional Initiatives

National demonstration programs and contests to identify and commend bicycle friendly towns help promote and disseminate good practices. They are worthy of emulation, along with public sector efforts to boost ridership through bike subsidies and depreciation allowances, as practiced, for example, by some German municipalities. The lead role of public agencies in supporting and endorsing bicycle use among its employees and officials, such as law enforcement officers in the course of their official duties, needs to be recognized. Efforts of this kind give bikes legitimacy, improve the climate for their use, and invite replication.

Public-private cooperation models, such as the French Club des Villes Cyclables, can result in effective advocacy for specific improvements. The networking by such groups domestically and across international boundaries helps to promote awareness of lobbying campaigns and can have a multiplier effect in keeping the concerns of advocates before policy makers and public officials in other countries and continents. These mixed bodies of officials and users can open improved channels of communication to and from decision makers.

To obtain the widest public support for neighborhood car restraints and speed restriction zones, a mobile street set for the life-size simulation of proposed changes has been fielded by the Swiss Automobile Club. The initiative allows residents to experience proposed solutions before they are actually put in place—an idea that merits replication.

Security Concerns

Registration and licensing systems, including indelible markings and the issuance of license tags for bikes by local police agencies as is the case in Switzerland, can help discourage bike theft, which is a problem in most of Europe. Several European cities are making reconditioned bikes, with non-standard fittings, often painted a distinctive "ugly" color, available to urban users free of charge to aid in identification and to discourage theft. The long-term effectiveness of these initiatives needs to be monitored.

Recommendations

Public agencies and individuals involved in decision making on bicycle and pedestrian promotion programs need to keep abreast of the experience of other countries such as cited in this and other reports. This can be done either in-house with the appointment of a bicycle/pedestrian coordinator, or through a contract with a qualified individual consultant, firm, or association.

Whatever the preferred, most cost-effective option, the individual(s) charged with monitoring relevant overseas developments should see to it that the information obtained is made available to the widest possible group of users.

The suggested networking activities involve the distribution of reports on overseas experience, attendance at conferences and the operation of an information clearing house.

The proposed clearing house should make itself known to appropriate professional associations and public interest groups. It should collect and distribute English language reports from overseas nations (and Canada) to state and local transit planners, designers and operators, public works departments and other elements of state and local government. The clearing house manager should seek out opportunities to share relevant experience at meetings and workshops that bring together city planners, traffic engineers and bicycle/pedestrian advocates.

Full use should be made of existing special interest groups concerned with cycling, the environment and the provision of services to the public, in particular, the Bicycling Federation. Their newsletters and periodicals provide both a source and a channel for experience exchange.

The formation of a prestigious advisory committee to the clearing house should also be considered. This committee would be well-served to include advocates from both public and private sectors, including advocacy groups such as the Bicycle Federation. Its advice should sought on the allocation of resources to bike and pedestrian facilities and the drafting of guidelines, policies and recommendations for action at the national, regional and local levels of government. The French Club des Villes Cyclables could serve as a model.

Literature References

Austria

1) Letter from Dr. Christian Roettinger, foreign press officer, City of Vienna, 10/22/91

2) Letter from Dr. Gerfried Brandstetter, Land Salzburg, Governor's Office, 12/11/91

3) City of Vienna: Radwegegrundnetz Wien, 1983
Stadt fuer Fussgaenger, 1985

Denmark

4) Letter from Lene Herrstedt, Head of Traffic Safety Research, Denmark Ministry of Transport, 2/10/91

5) Lene Herrstedt: The Experience from the Danish Road Directorate's Experiment with Environmentally Adapted Through Roads in Three Pilot Towns, 1991

6) Booklet: Cycling in Denmark, Road Directorate, Ministry of Transport, 1989

Road Data Laboratory, Road Directorate, Denmark:

7) Information Sheet 50: Safety of Cyclists in Urban Areas, 1991

8) Information Sheet 47: Safety and Environment

9) Report 63: Consequence Evaluation of Environmentally Adapted Through Road in Skaerbaek, 1988

10) Report 52: Consequence Evaluation of Environmentally Adapted Through Road in Vinderup, 1987

Road Directorate, Ministry of Transport:

11) Road Standards for Urban Areas: Volumes 0 to 10

12) 0. Road Planning in Urban Areas, 55 pp. (English)

13) 1. Premises for the Geometrical Design
14) 2. Alignment Elements
15) 3. Cross Sections
16) 4. Intersections
17) 5. Path/Road Crossings
18) 6. Path Intersections
19) 7. Speed Reducers, 55 pp. (English)
20) 8. Pedestrian Streets
21) 9. Areas for Parking, Stopping, etc.
22) 10. The Visual Environment (to be published)

23) Eigil Koop, Technical Director, Danish State Railways: On the recent engagement of bicycles and trains in Denmark. Working paper, 1989

Finland

24) Letters from Liikenneturva (Central Organization for Traffic Safety in Finland), 2/1/91, 10/31/91

25) Liikenneturva Research Report: Slowly Driving Motorists (Sirpa Rajalin), Helsinki, 1991

26) Liikenneturva Research Report: On the gap left by motorists when overtaking cyclists (Matti Koivurova, Juha Valtonen), Helsinki, 1987

27) V.P. Kallberg and M. Salusjaervi: The Effects of Pedestrian and Bicycle Paths on Traffic Accidents, Helsinki, 1982

28) Liikenneturva Research Report: Use of Warning Pennants in Bicycles (Liisa Ornane), 1972

France

29) Transportation Counselor, Embassy of France, Washington, DC: Telefax, 10/17/91

30) Letter from Maryse Fluteau-Cohen, CETUR, 11/5/91

31) SETRA, CETUR: Securite des routes et des rues; Extraits du document provisoire, August 1991

32) MELTE, CETUR: Voirie urbaine; guide general de la voirie urbaine, conception, amenagement, exploitation; extraits (Association des Ingenieurs des Villes de France)

33) CETUR: Amenagements specifiques—Les deux roues legers

34) CETUR: Catalogue des Publications, Bagneux, France, 1991

35) Club des villes cyclables—Plaquette de presentation

36) 2emes Journees de recontre du Club des villes cyclables, Lorient, 1990

37) MELTE, CETUR: Les deux roues legers; amenagements simples et securite en milieu urbain (Fiche technique)

38) CETUR: Catalogue des publications du CETUR, mise a jour, 11/91

39) H. G. Vahl, J. Giskes: Traffic Calming Through Integrated Urban Planning, Amarcande, Paris, 1990

40) F. Loiseau—van Baerle: Better and Safer Streets Through Traffic Calming, Paris, 1990

41) Le Lettre du Maire: Gronigen: Le Ville Ou Le Velo Est Roi, 10/24/91

Netherlands

42) Road Directorate, Ministry of Transport: Speed Management in Urban Areas, International Seminar, May 1990

43) Letter from Jacob van Hekke, Netherlands Embassy, Washington, DC, 7/11/91

44) Fax from Jacob van Hekke, Netherlands Embassy, Washington, DC, 12/24/91

45) Netherlands Centre for Research and Contract Standardization in Civil and Traffic Engineering: Van Woonerf Tot Erf, 1989

46) Royal Dutch Touring Club: *Woonerf*, A New Approach to Environmental Management in Residential Areas and the Related Traffic Legislation, 1980

47) Tom Godefrooij, Policy Coordinator, Dutch Cyclists Union: Combinations of bicycle and trains in the Netherlands, working paper, 1989

48) Public Innovation Abroad 8/86: Bike and Ride Becoming Popular in Europe

Germany

49) Letter from Heiner Monheim, Transportation Ministry, North Rhine-Westphalia, 10/1/91

50) Heiner Monheim, Rita Monheim-Dandorfer: Strassen fuer Alle, 532 pp., Rasch und Roehring pub., Hamburg, 1985

51) ILS Dokumentation: Radwege an Strassen, auths: Heinz Klewe, Karl Otto Schallaboeck, Bonn, 1991

52) Bonner Fahrradkongress, June 10/11, 1991 (German abstracts)

53) Dr. Hartmut Keller, Bundesanstalt fuer Strassenwesen: Results of the area wide traffic calming project, 9/88

54) Stadt Buxtehude: Buerger-Info Flaechenhafte Verkehrsberuhigung

55) Proceedings: 4. Kolloquium Ergebnisse aus drei Modellstaedten, 5/88

56) New Life for City Centres: Planning, Transport and Conservation in British and German City Centres, Carmen Hass Klau, pub. Anglo-German Foundation, London, 1988

Norway

57) Letters from Tor J. Smedby, Senior Supervising Engineer, Directorate of Public Roads, 9/11/91, 1/14/92

Norway Directorate of Public Roads:

58) Guidelines on the planning and design of pedestrian and bicycle paths

59) Guidelines on traffic calming

60) Proposal for Revision of Road Design Policy Manuals

Sweden

61) Discover Sweden by Bike: The Swedish Tourist Board, March 1991

62) Letter, Publications in Swedish from Cykelfraemjandet, Stockholm, 1/31/92

Switzerland

63) Letter from S. Lutz, Deputy Secretary General, Swiss Association of Cities, Bern 12/4/91

64) Touring Club Suisse: Sicherheit im Quartier, Zurich 1988

65) City of Bern, Infor 32; Mehr Sicherheit fuer Velo und Mofafahrer, 1988

66) City of Bern, Info 33: Mehr Wohnqualitaet und Sicherheit im Quartier, 1988

67) Mueller-Steinag, Luzern: Wohnstrassen-Doku, 1988

68) Bundesamt fuer Umwelt: Luftreinhalte Verordnung, Massnahmen beim Verkehr, Bern, 1990

United Kingdom

69) Letter from S. Keswick, Traffic Policy Division, Department of Transport, 11/9/91

70) LTN 1/86: Cyclists at Road Crossings

71) LTN 2/86: Shared Use by Cyclists and Pedestrians

72) LTN 1/87: Getting the Right Balance

73) LTN 2/87: Signs for Cycle Facilities

74) LTN 1/89: Making Way for Cyclists

75) TAL 1/87: Measures to Control Traffic for the Benefit of Residents, Pedestrians and Cyclists

76) TAL 8/89: Innovatory Cycle Scheme

77) TAL 9/89: The South East Cambridge Cycle Route

78) TAL 2/90: Speed Control Humps

79) TAL 4/90: Tactile Markings for Segregated Shared Use by Cyclists and Pedestrians

80) TAL 3/90: Urban Safety Management Guidelines

81) TAL 5/90: The Nottingham Cycle Route Network

82) TAL 1/91: Cycling Bibliography

83) TAL 7/91: 20 mph Speed Limit Zones

84) Circular Roads 4/90: 20 mph Speed Limit Zones

85) Circular Roads 3/90: Road Humps

86) DOT Publication: Pedestrian Safety; New Proposals for Making Walking Safer

87) Traffic Topics 1, 4/89: Traffic Regulation in Urban Areas

88) Traffic Topics 2, 4/89: Tackling Traffic in Historic Towns

89) Rodney Tolley: Calming Traffic in Residential Areas, Brefi Press, 1989

90) Devon County Council: Traffic Calming Guidelines, 1991

91) Don Mathews: Manuscript for chapter on best environmental practices for World Wildlife Fund (to be published 1992)

92) Johanna Cleary: Cyclists and Traffic Calming, Technical Guide; Cyclists' Touring Club, 1991

93) Transport and Road Research Laboratory: Evaluation of Pedal Cycle Spacers, Digest of Report, G.R. Watts, 1984

94) Selection of articles from Surveyor Magazine, U.K. and press clippings from U.K. dailies

United States

95) Michael A. Replogle: Bicycles and Public Transportation; New Links to Suburban Transit Markets, 1983

96) George G. Wynne (ed.): Learning from Abroad: Traffic Restraints in Residential Neighborhoods; Transaction Books, 1980

97) Marcia D. Lowe: Worldwatch Paper 90: The Bicycle—Vehicle for a Small Planet, 1990

Public Innovation Abroad

98) Cycling—Not Just for Health and Fun, 3/91

99) Muenster Tries 'Park and Bike,' 3/91

100) City Compensates Staff for Bike Use, 3/91

101) Golden Wheel or Rusty Spoke?, 6/88

102) Austrian Rail Cars Are Bicycle-Friendly, 12/87

103) New Look in Street Furniture and Playgrounds, 1/89

104) City of Charlottesville, Virginia: Press release, July 15, 1985: Bike Spacers Used in Bicycle Safety Program

International

105) Commission of the European Communities, Directorate General for Transport: Policy and Provision for Cyclists in Europe, Brussels, 1989

106) Proceedings: Velo City 87 International Congress, Groningen: Planning for the Urban Cyclist

107) European Cyclists Federation: Bicycles and Trains Project, on behalf of the European Commission. Study in progress

108) European Cyclists Federation: ECF Digest, November 1991

109) ECF: Transport in Central/Eastern Europe, January 1992

110) ECF: Correspondence with World Health Organization on Cycle Helmet Promotion Programs, 1991

111) ECF: Listing of Member Associations, November 7, 1991

112) International Conference: Speed Management in Urban Areas, Copenhagen, May 1990

*U.S. G.P.O.:1993-343-273:80091